ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

Nos. 65, 66.] MAY AND JUNE. [1892.

CCXLIII.—VANILLA DISEASE.

(*Calospora Vanillæ*, Massee.) With plate.

In the year 1887 an appeal was made to Kew for assistance and advice in regard to a disease that had attacked vanilla plants in the Seychelles. These islands as well as Réunion and Mauritius have taken up the cultivation of vanilla and a not inconsiderable industry has been established there in recent years. The first information respecting the disease was contained in a letter written by Mr. J. J. Sharp, dated 10th May, 1887 :—"I have referred previously to the Sans Souci Estate "in one of my letters to you, remarking upon the fine and healthy "appearance of the vanilla vines and pods, but it appears Mr. Edwards "finds hundreds of pods are damping off, and as is always the case, the "plumpest and finest pods succumb first. These turn black at either "end or in the centre, and in the course of a day or two drop off the "vine. . . . Mr. Edwards said the disease was confined to a given area, "and then he admitted it was a flat, damp piece of land without "sufficient drainage. This is exactly what happened at the Cascade "Estate and under exactly the same conditions when they lost a very "large quantity of pods."

The disease after this time appears to have become more general in estates in Mahé, and in order to protect the planters in their efforts to deal with it, a Regulation was passed [No. 3 of 1887], "to prohibit the introduction of vanilla creepers" into the Seychelles from Mauritius and Réunion islands. At that time it was believed that the vanilla plants in the latter islands were also affected. This, however, does not appear to have been the case. In reply to applications made to Kew the following correspondence was addressed to the Colonial office.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

Royal Gardens, Kew,
October 27, 1887.

SIR,

I AM desired by Mr. Thiselton-Dyer to inform you that he has received from the Seychelles direct, as well as from the Director of

Forests and Gardens at Mauritius, correspondence and specimens bearing upon a disease which has appeared amongst vanilla plants at the Seychelles.

2. Specimens of diseased vanilla pods were received here from Mr. E. H. Edwards, a planter at the Seychelles, with a letter dated the 10th May 1887, and subsequently (31st May) we were addressed on the same subject by Messrs. Wright, Layman, and Umney, wholesale druggists in the City, who forwarded correspondence received by them from the Seychelles. Recently (September 10th) we received from the Director of Forests and Gardens at Mauritius specimens of vanilla obtained from the Seychelles with insects upon them. These latter were supposed to be in some way connected with the disease.

3. The vanilla cultivation is well known to be a staple industry of the Seychelles, and Mr. Thiselton-Dyer fully shares the opinion that anything affecting its permanence and welfare is a matter of deep importance to the inhabitants.

4. After a careful consideration of the circumstances as so far presented to him Mr. Thiselton-Dyer is of the opinion that the cause of the disease is to be sought not in any insect or fungoid pest but in the situation and nature of the soil and drainage.

Mr. Scott, the Assistant Director of the Gardens at Mauritius, appears to have arrived at the same conclusion. He states in a letter (received here 2nd May 1887), "In my opinion there is no disease. The plants are only exhausted from overcropping, bad drainage, want of shade, &c."

5. The pods received from Mr. Edwards were so decomposed that it was impossible to trace anything upon them. The specimens of insects received on pods from the Director of Forests and Gardens at Mauritius proved to be mites (Acari), and in the opinion of an officer of the British Museum (Natural History), to whom they were submitted, "it does not seem probable that they are the cause of the disease."

6. The investigation of a disease of this kind can only be satisfactorily pursued on the spot and after observations have been continued during one complete season; but the information at present available points to questions of drainage and shade, which are matters well within reach of the cultivators themselves.

I have, &c.

The Hon. R. H. Meade, C.B.,
Colonial Office.

(Signed) D. Morris.

Royal Gardens, Kew, to Colonia Office.

Royal Gardens, Kew,
November 23, 1887.

Sir,

With reference to my letter of the 27th October on the subject of the disease of vanilla pods at the Seychelles, I am desired by Mr. Thiselton-Dyer to forward the enclosed copy of a letter received from Mr. George Massee, to whom diseased vanilla pods received in May last were given for examination.

2. It appears after careful inquiry that Mr. Massee has detected in the pods a parasitic fungus belonging to the genus *Peronospora*; but before he can arrive at any practical conclusion it is necessary to obtain a supply of vanilla pods in different stages of growth for detailed examination.

3. Some of the pods might be sent in spirit whilst others might be sent in a small box, in a living state, attached to portions of the vine.

I have, &c.

The Hon. R. H. Meade, C. B., Colonial Office.

(Signed) D. Morris.

Enclosure.

A fungus belonging to the *Peronosporeæ* has been detected in the tissues of the vanilla pods received from the Seychelles. It is desirable that further material should be examined in order to ascertain the relation between fungus and disease. Specimens of pods, as rotten as possible (from the disease), even those of last season, if obtainable, should be placed in spirit, and other pods in the earliest stage of disease, showing a white mouldiness outside, sent alive.

(Signed) G. Massee.

The specimens desired for investigation at Kew were received from his Honour T. Risely Griffith, C.M.G., the Administrator of the Seychelles, in February 1890. They were submitted for examination to Mr. Massee, who has prepared the following exhaustive Report:—

In May 1887 Mr. D. Morris, M.A., F.L.S., Assistant Director, Royal Gardens, Kew, submitted to me for examination some vanilla "pods" or fruits from the Seychelles supposed to be diseased. Owing to imperfect packing the material proved useless for investigation. In February 1890 a second consignment was received representing every stage of the disease, which shows conclusively that the disease is caused by a microscopic fungus, *Calospora vanillæ*. *Vanilla planifolia*, Andr., is the species cultivated.

The first consignment consisted of "pods" or capsules only, and these, having been wrapped up while damp in lead paper, arrived in a half-decayed condition and completely covered with minute fungi such as *Eurotium herbariorum*, which had undoubtedly developed during the journey, thus rendering useless the material for investigation. A small species of *Pythium* was met with in fair abundance in the tissues; but this, as will be shown, had nothing to do with the disease that was causing the wholesale destruction of the vanilla plants.

The second lot of material arrived in excellent condition, and illustrated every stage of the disease from the earliest indication of its influence on the aerial roots to the dry and shrivelled leaves and stems, and included also a good supply of material in alcohol. The living stems had been cut into pieces about half a yard long, each piece bearing two or three leaves and aerial roots, often two yards or more in length. These pieces, over 30 in number, were packed between thick layers of blotting paper, and on being opened out were perfectly fresh and without a trace of mould, due probably to the moisture from the specimens having been absorbed by the superabundance of blotting-paper. The whole were packed in an air-tight box.

A preliminary examination of the material showed the presence of three apparently distinct species of fungi, distributed as follows:—

On some of the living leaves exceedingly minute subtremelloid pustules of a dull red or amber colour were present, springing in small groups from slightly discoloured patches. These were most abundant on the upper surface of the leaf, but in some instances occurred on both

surfaces and are only just visible to the naked eye, rarely reaching 5 mm. in diameter. A microscopic examination showed that the pustules consisted of masses of gonidia belonging to a fungus agreeing with the characters of the genus *Hainsea* of Saccardo and Ellis. As to whether *Hainsea* is distinct from *Glæosporium* seems more than doubtful; this, however, is immaterial in connexion with the present investigation, as the *Hainsea* will be shown to be simply a form species. Some of the leaves showed no external trace of the fungus; but mycelium was present in the tissues, and in some instances the *Hainsea* appeared at a later stage on leaves that were placed under a bell-jar and kept moist. Some time after the fungus has made its appearance on the leaves it also shows itself on the stem and aerial roots, which originate from the stem laterally too, and close by the insertion of the leaves; but it rarely extends for more than an inch from the insertion of the leaves, and its presence on these organs is due to the extension of mycelium from the leaves.

All the dying and dead leaves, along with those portions of the stem indicated above, were studded with the pale yellow waxy-looking, agglutinated masses of gonidia belonging to the form-genus *Cytispora*. The gonidia, when mature, exude through the ruptured epidermis of the leaf in the form of minute, elongated, viscid filaments, being held together by mucus derived from the gelification of the external portion of the walls of the gonidia. These filaments in drying assume various irregular masses, which persist on the surface of the leaf for a considerable time. These masses are arranged in more or less circular groups, extending to ·5 cm. in diameter; not unfrequently most of the viscid filaments forming a group become confluent while moist, and form an irregular waxy cake. The clusters are usually produced in such close proximity that the whole surface of the leaf is practically covered. The *Cytispora* is most frequently confined to the upper surface of the leaf, but not unfrequently both surfaces are covered. At a later stage, like the *Hainsea*, the *Cytispora* extends to the stem for a short distance from the insertion of the leaves. In old bleached leaves where the *Cytispora* spore-masses have been removed by rain, the surface presents a blackened appearance due to the numerous black pycnidia of the fungus which originate in clusters from a common mass of pseudoparenchyma, the stroma. At a later stage the central portion of the stroma of the *Cytispora* produces perithecia, enclosing spores contained in asci, which agree in all essential points with the genus *Calospora*. The mycelium of the *Hainsea* form occurs in greatest abundance in the tissues just below the epidermis, running between the cells and surrounding them with a mesh of hyphæ, but not piercing their walls. The hyphæ are of uniform thickness, measuring from 3–3·5 μ in diameter. At certain points where several hyphæ cross, lateral branches are given off which become closely entangled and eventually form a small, colourless cushion of pseudoparenchyma which destroys the epidermal cells lying immediately above, the cuticle at the same time bulging up. From the lower surface of the stroma numerous hyphæ extend into the leaf between the cells, completely destroying the tissues. From the upper surface of the stroma, that is, the surface lying nearest the cuticle, numerous slender cylindrical aseptate hyphæ grow up side by side; these are the gonidiophores, which, from their first appearance are slightly clavate at the tips; these thickened apical portions continue to increase in size until they assume an elliptic-oblong form, and are then cut off from the gonidiophores by a transverse septum, and escape through the ruptured cuticle, forming the minute

amber-coloured masses of gonidia involved in mucus already described. The gonidiophores are simple or branched, variable in length, extending to 25 μ the average being about 14–16 × 3 μ the gonidia are constant in form and size, measuring 9-10 × 3·5–4 μ, and, seen by transmitted light are almost colourless. Sown in water these gonidia germinate within 12 hours, emitting a germ-tube from near one end, which soon produces short lateral branches at right angles; the whole perishes within two or three days, and in several cultivations the development never passed beyond the condition described above. When sown in a sterilized decoction of raisins and gelatine, the gonidia germinated as above, but the mycelium was much more vigorous in its growth, although not thicker, measuring 3 μ in diameter, sparsely septate, and becoming slightly thicker near its point of origin from the gonidium. In rare instances two germ-tubes are produced, one from each end of a gonidium, but in such cases one of the two remains in a rudimentary condition. On the third day after the commencement of germination small elliptical, colourless, secondary gonidia measuring 4 × 2 μ are cut off from the tips of most of the branches.

These secondary gonidia, after becoming detached, reproduce themselves to an enormous extent by budding, but were never seen to emit germ-tubes. In flask cultures in a sterilized, clear solution of plums the gonidia within 10 days give origin to a copious weft of mycelium which produces microgonidia below the surface of the liquid; these reproduce themselves so rapidly by budding that the originally clear solution becomes turbid, and this continues until the nutritive material is exhausted, when the mass of yeast-like cells sink to the bottom like a precipitate. No further development could be obtained from the cells produced by budding although sown in varions nutritive solutions, including the liquid from crushed living vanilla leaves obtained from the Royal Gardens, Kew.

A quantity of leaf-mould mixed with water was thoroughly sterilized by intermittent boiling in a flask until the water had evaporated, leaving the soil moist, into this was placed two drops of the decoction of plums containing the budding condition of the secondary gonidia, the flask was closed with sterilized cotton wool, and kept at a temperature of about 70°F. for six days, when a quantity of water recently boiled and proved by microscopic examination to be pure was added, and the whole thoroughly shaken up; on examination the water was found to be charged with budding forms of the secondary gonidia in all stages of development, but prolonged examination failed to show any other form of development. Some of the cells exceeded in size the measurements given above, reaching to 6–7 × 4–5 μ and not unfrequently formed little colonies of concatenate gonidia of various sizes organically attached. The contents of the flask were kept under observation for some weeks, but no other phase of development was observed.

The above experiment suggests that when the *Hainsea* gonidia are washed off the leaves by rain and carried to the ground, they germinate and produce yeast-like colonies of cells by budding, but what these cells eventually give origin to is unknown. Living vanilla leaves were infected with the *Hainsea* gonidia, but always without result, although tried in a variety of ways both on the upper and under suface of the leaf, and by being placed in wounded parts, from which it may be concluded that the *Hainsea* cannot reproduce itself directly on the living vanilla plant.

By the time the *Hainsea* is fully developed, owing to the ravages of its mycelium, the leaf, has become yellow and is evidently dying, and at

this stage the *Cytispora* (= *Cytospora*, Sacc) begins to show itself in the form of verp minute clusters of black points covered by the cuticle. A section of the leaf taken through one of these clusters shows that the points are black-walled pycnidia partly sunk in a common stroma. This stroma, which is convex on the side next the epidermis, is formed from mycelium indistinguishable from that of the *Hainsea* which preceded it in the leaf, and gives off from its under surface and margin numerous septate, branched hyphæ about 4μ in diameter, the branches at once penetrate the cells of the leaf, where they usually form a coiled mass. The epidermal cells of the leaf have thick walls furnished with large pits, and it is through these pits, which are opposite to each other in contiguous cells, that the hyphæ pass from one cell to another, becoming very much attenuated in the pit and expanding again at once to the normal width on entering the cell. I did not succeed in observing the origin of the pycnidia from the substance of the stroma; but when fully formed, a vertical section through the stroma shows them to be circular in outline, with a slight prominence at the apex bordering a minute pore through which the gonidia escape at maturity. The pycnidia are frequently distorted from mutual pressure. The base of the pycnidium is buried in the substance of the stroma, and the whole structure has a thick wall of pseudoparenchymatous tissue composed of several layers of cells which appear in section, whether vertical or transverse, to be arranged in fairly regular concentric layers. The walls of the outermost layer are black or dark brown and rather thick, and sharply define the pycnidium from the stroma in which it is to a great extent immersed. Proceeding inwards the walls become colourless, very thin, and the cells are filled with granular, vacuolated protoplasm; the innermost layer gives origin to the slender gonidiophores, which vary in length, and produce at their tips the elliptic-oblong, colourless gonidia, measuring 14–16 × 6–7μ. The gonidia at first have an external thin, hyaline, mucilaginous layer. The cuticle is ruptured by the upward development of the stroma and the gonidia ooze out of the pycnidia in the form of mucilaginous tendrils, which forms the pale yellow waxy masses on the surface leaf, as already described. The clusters of pycnidia are small at first; but the stroma continues to grow and increase its area for some time, at the same time producing pycnidia from the newer peripheral portion; there is no tendency towards a concentric arrangement of the pycnidia. *Cytispora* gonidia sown in water produced within two days one or two germ-tubes, which develop into much-branched septate hyphæ, the cells nearest the gonidium becoming swollen into a broadly elliptical or globose form and presenting a moniliform appearance, due to being constricted at the septa; no further development took place, and at length the mycelium died. In a nutritive solution development commences as above; but after a copious formation of mycelium stromata are formed as follows. At certain points, where several hyphæ intersect, numerous transverse septa appear, cutting the hyphæ into short cells; these cells give origin to lateral branches, which, after growing erect in a fasciculate manner for some distance, become irregularly branched, the branches becoming interwoven and forming a compact mass more or less spherical in form, the whole stroma resembling a sphere supported on a short, thin stalk that originates from the mycelium. At first the stroma has a well-defined outline; but eventually the external cells of the basal half nearest the stem-like base grow outwards as blunt papillæ; these elongate directly into septate, branched hyphæ, which radiate from the stroma on every side and pass directly into the nutritive solution for the purpose of supplying the developing stroma with nutrient material. In

slide cultures these stromata attain a diameter of 2 mm. in about three weeks, and are quite colourless. One promising example was watched from day to day for the appearance of black points which it was supposed would indicate the formation of pycnidia; but in this I was disappointed, and in place of black points a mass of gonidia was seen covering the stroma. The gonidia agreed exactly with those of the normal *Cytispora* produced on the leaves. The stroma, after remaining for some time in alcohol, was examined; a vertical section showed the presence of two pycnidia similar in shape to those already described, but differed in the almost total absence of colour from the outer cells of the wall, and in the fewer number of concentric layers composing it, only three being present. The umbonate apex did not project above the level of the stroma.

The spores germinated in a nutritive solution in a manner exactly similar to those obtained from the leaves, and there seems to be but little room for doubt but that the differences observed between the normal development and the slide cultures were caused by the different conditions under which the two were respectively developed. Living uninjured vanilla leaves infected with *Cytispora* gonidia yielded no results, the gonidia germinated on the moist epidermis, but the germ-tubes appear not to be able to pierce the epidermis, or to enter through the stomata; on the other hand, when the gonidia were placed on a portion of a leaf from which the epidermis had been removed, germination took place, and the mycelium spread in the tissues, followed by the production of pycnidia in small numbers and imperfectly developed, whereas when the gonidia are placed on a dying leaf, where disintegration of the tissues has commenced, pycnidia are produced in abundance. The above experiments show that the *Cytispora* is a true saprophyte, and will not reproduce itself on uninjured living vanilla leaves.

By the time the *Cytispora* has completed its development the whole of the sap and protoplasm has disappeared from the leaf, which is consequently dry and shrivelled, and so long as it remains in this condition no further fungal development takes place, but if the leaf is kept damp the *Cytispora* stromata produce perithecia from the central portion, which originate as follows. A vertical section through the central portion of the stroma shows a minute spherical weft of intricately interwoven hyphæ, filled with granular protoplasm and completely surrounded by a layer of slender, thin-walled, yellowish hyphæ somewhat concentrically arranged; the central weft appeared to be perfectly homogenous, and showed no trace of an ascogonium or "Woronin's hypha," but the difficulty of obtaining a median section and at the right time may possibly account for the absence of any differentiation in the central weft. For some time the entire body retains its spherical form but continues to increase in size, due mostly to the increase in thickness of the bounding wall, but also to some extent to the growth of the central weft; eventually the apical portion of the outer wall, or that portion nearest to the free surface of the stroma grows upwards in the form of a cone until it bursts through the stroma. At this stage the young perithecium is conical in outline with a rounded base, the basal portion enclosing the spherical weft of hyphæ, the bounding wall being 6–8 cells in thickness, pseudoparenchymatous below, but in the upper portion the hyphæ run in parallel rows. The two or three outer layers of the wall all round are at this stage differentiated by the dark colour and greater thickness of their walls, the walls of the inner layers being colourless, very thin, and containing granular protoplasm; the apical portion of the perithecium, consisting of parallel hyphæ,

continues to elongate and becomes slightly curved, forming the neck, and on the portion above the stroma some of the peripheral hyphæ become free from the wall and form hairs. Contemporaneous with the development of the neck of the perithecium, the cells of the inner rows of the basal portion of its wall commence to elongate in the form of blunt papillæ, which grow into the central weft of hyphæ, causing its complete disintegration, leaving a cavity into which the papillæ or young asci and paraphyses extend. Whatever the central weft of coiled hyphæ may be the homologue of, its behaviour in the present instance suggests its function to be that of forming the cavity of the perithecium, serving as a nucleus round which the wall forms, and eventually disappearing when the asci develop, these latter soon completely filling the ready-made cavity. The origin of the neck-canal was not determined, but it certainly takes place at a later period than the basal cavity. The asci when mature are cylindrico-clavate and attenuated below into a slender elongated base. They measure 90–100 × 12–14μ. The spores are eight in number in an ascus, biseriate, sub-cylindrical with rounded ends, slightly curved, colourless, and triseptate at maturity, and measure 15–16 × 5μ. Paraphyses scanty, linear, equal, aseptate, 80–100 × 2μ.

The ascospores germinate in water within 12 hours, producing one or more germ tubes which elongate by apical growth, become septate and produce a few lateral branches; no further development was observed, the mycelium dying for want of nourishment. In a nutritive solution the spores germinate as described but growth is much more vigorous, and in about three weeks very minute pustules were formed by panicles of short, erect hyphæ, from the tips of which gonidia were cut off resembling in form and size those produced by the *Hainsea* form on living leaves. In the cultures, the stroma was rudimentary or entirely absent, but the gonidia germinated in a decoction of plums in a manner exactly similar to those obtained from the leaves, and also repeated themselves by budding, and there seems no room for doubt but that the gonidial form of reproduction produced by the germinating spores of the *Calospora* agree with *Hainsea* found on living vanilla leaves. The accuracy of the above statement was verified by the appearance of the *Hainsea* on living vanilla leaves obtained from the Royal Gardens about three weeks after being infected with *Calospora* spores. The leaf that produced the *Hainsea* was placed under a bell-jar with its base in water; another infected leaf suspended from the top of the same bell-jar yielded no result; from this it appears that *the presence of an excess of moisture in the leaf favours the development of the fungus.* The ascospores were placed on the uninjured upper surface of the leaves. The germ tubes of the *Calospora* enter the tissues of the leaf through the stomata, and the leaf is the only portion of the plant through which the parasite can gain access to the interior, as the stem and aerial roots are protected by a very thick, continuous cuticle; the growing points of the descending aerial roots are certainly tender and imperfectly protected, but I have not met with a plant attacked at these points. The production of the *Hainsea* from the *Calospora* closes the life-history of the fungus under consideration, although the proof from artificial cultures is not a complete sequence; for instance, the *Hainsea* stage could not be made to give origin to the *Cytispora* form, nevertheless the cycle has been completely proved as follows: the perithecia of the *Calospora* has been shown to originate from the stroma of the *Cytispora*, and the *Hainsea* has been produced from the germinating spores of *Calospora.*

Summary.

The above account shows that healthy vanilla plants can be killed by a microscopic fungus which may be called *Calospora vanillæ* in the following manner.

The earliest form of the pleomorphic fungus, the *Hainsea* form, attacks the living leaves, and by means of its spreading mycelium destroys their tissues, thereby causing the death of the plant by destroying those organs on which the plant depends for an indispensable portion of its food, as also for the regulation of the amount of water contained therein. The death of the individual plant is caused entirely by the *Hainsea* form of the fungus, as the *Cytispora* and *Calospora* forms only appear when the leaf is already killed. The statement that the tips of the "pods" or capsules and of the aerial roots first show symptoms of disease, although not scientifically correct, is quite in harmony with the above statements, for although the leaves are first attacked, and consequently first diseased, yet the mycelium of the fungus remains in the tissues for some weeks before it bursts through the cuticle to liberate its gonidia or reproductive organs, but during the interval between the first entrance of the fungus into the leaf and its reappearance on the surface in the mature condition, its mycelium has disorganised the tissues, thereby preventing the performance of those functions already stated, and consequently rapidly growing portions of the plant as young fruits and aerial roots, first show symptoms of disease at the tips on account of their being farthest from the source of food supply, and would probably show external signs of disease even before the leaves themselves.

Preventive Measures.

It is impossible to suggest remedies for the probable various causes of the vanilla disease without a thorough investigation of all the circumstances, conducted on the spot; yet assuming that the most important factor in causing the disease is the fungus already described, it would appear that ordinary precautions on the part of the cultivator, by taking advantage of the weak point in the sequence of development of the parasite, would soon result in its total disappearance. It must be remembered that the *Hainsea* form which appears on the living leaves and does all the mischief, cannot reproduce itself directly on other living leaves, but is followed at a later stage on the dying leaves; that is, the *Hainsea* mycelium produces another kind of fruit on the dying leaves, the *Cytispora* form, which possesses the power of reproducing its own form for probably several generations on dying leaves; eventually, when the leaf is quite dead, the masses of mycelium or stromata that produced *Cytispora* gonidia now give origin to the third or *Calospora* form, and when it is remembered that the *Calospora* spores *produced only on dead leaves*—can alone reproduce the *Hainsea* form on living leaves, it follows that *if all fading and dead leaves are destroyed by burning*, the fungus pest would soon disappear, or be at least so reduced as to produce no appreciable damage. Judging from the abundant supply of dead leaves literally teeming with the *Cytispora* and *Calospora* forms of the fungus that were forwarded with the material for investigation, it may be presumed that large quantities of leaves in a similar condition are lying about in the vanilla plots. If such is the case they should at once be burnt, as I venture once more on repeating the statement that *the continuance of the disease depends entirely on the presence of such diseased dead leaves.* The fact that the appearance

of the disease in the Seychelles islands is of recent date suggests the idea that impaired vitality of the vanilla plants may favour the spread of the disease. It is not known whether vigorous growing vanilla plants can be infected; it is almost certain that weakly specimens would be more susceptible. Direct proof of this could only be obtained on the spot, but the statement accompanying the material, that the disease was most prevalent in flat damp places where the drainage was insufficient, favours this idea. The development of the *Calospora* condition on the dead leaves depends entirely on moisture; if the leaves remain dry no growth takes place, but the mycelium or stromata remain quiescent, and judging from analogy can remain in this condition for a considerable length of time, and on being moistened resume their activity. In like manner it is probable that the mycelium of the *Hainsea* stage in the living tissues may under certain conditions remain for a considerable time in the leaves and stem without showing itself externally; hence it would be highly imprudent to use even apparently healthy plants obtained from infected areas for stocking new estates.

In conclusion it may be stated that the above described vanilla disease is not confined to Mauritius, the Seychelles, and Réunion islands; specimens of *Vanilla planifolia* were received at Kew in 1886 from Antigua, New Granada, showing all three forms of the fungus; the *Hainsea*, not known at that time to be a form-species, was described as *Glœosporium vanillæ*, Cke. and Mass., in *Grevillea*, vol. 15, p. 18.

Since the above was written all the stages of the above-described disease have been followed on cultivated orchids at Kew, belonging to the genera *Oncidium* and *Dendrobium*.

George Massee.

Explanation of the Plate.

Fig. I. Portions of stem, leaf, and aerial root of *Vanilla planifolia*, showing the *Cytispora* and *Calospora* stages of disease; nat. size.

Fig. II. Section through a pustule of the *Hainsea* stage of the disease; × 300.

Fig. III. *Hainsea* gonidia germinating; × 400.

Fig. IV. Secondary gonidia of *Hainsea* reproducing themselves by budding; × 400.

Fig. V. Section through pycnidia and portion of stroma of the *Cytispora* form; *a*, *a'*, stroma; *b*, *b'*, *b''*, pycnidia in various stages of development; × 250.

Fig. VI. Section through perithecia and portion of stroma of *Calospora vanillæ*; *a*, *a'*, stroma; *b*, *b'*, *b''*, perithecia in various stages of development; × 250.

Fig. VII. Ascus containing spores and paraphyses of the same; × 400.

CCXLIV.—BOTANY OF MILANJI IN NYASSA-LAND.

In the *Kew Bulletin*, 1891, p. 183, an account was given of a journey made on the frontier of the British Protectorate of Nyassa-land in central tropical Africa, by Mr. John Buchanan, C.M.G., the Acting-Consul. One of the most striking features of Nyassa-land is the range of somewhat precipitous mountains occupying a commanding position to the south of Lake Nyassa and giving rise to numerous tributaries of the Zambesi river.

Recently these Milanji mountains have been visited by Mr. Alexander Whyte, a naturalist attached to the staff of Mr. H. H. Johnston, C.B., Her Majesty's Commissioner and Consul-General for the territories under British influence to the North of the Zambesi. A report of Mr. Whyte's journey is given in the "Papers relative to the Suppression of Slave-raiding in Nyassa-land, Africa," No. 5 (1892), presented to Parliament, June 1892. The following extracts contain references to the plants of the districts visited. Mr. Whyte's botanical collections have not yet been critically examined in this country.

Mr. Whyte to Commissioner Johnston.

The Residency, Zomba, British Central Africa,
November 18, 1891.

Having returned from exploring and collecting specimens of the flora and fauna of the mountain and district of Milanji, I have now the honour to hand you my Report on the same.

Milanji is an isolated range of, for the most part, precipitous mountains, the main mass forming a huge natural fortress of weather-worn precipices, or very steep rocky ascents, sparsely clothed with vegetation. Many of its gullies and ravines are well wooded, and in some of them fine examples of grand African virgin forest are met with. The route by which I ascended the mountain from the plain, on the 20th October, led up from its south-east face, and at first zig-zagged over steep, grassy hills, down precipitous gorges, and across rocky streams, with beds of large water-worn granite boulders, which, when flooded, become impassable mountain torrents. Further on the ascent became more difficult, and I clambered over precipices, holding on by tufts of grass, roots, and scrub, which gave but slender support and scanty foot-hold. Once round these precipitous bluffs an interesting wooded gorge was entered, still steep and difficult, but with better foot-hold on the projecting rocks and tree-roots; and most welcome was the kindly shade after hours of toil in a burning sun, rendered doubly fierce by the reflection from the scorching hot rocks.

Here, too, an interesting change in the vegetation was at once perceptible, plants of the lower slopes being mostly replaced by species new to me, and in many instances approaching the flora of temperate climes, such as brambles and well known old forms of papilionaceous and composite plants. Ferns, too, became more numerous, and now and again we scrambled through perfect fairy dells of mosses, fern-fronds, selaginellas, and balsams, with miniature waterfalls showering their life-giving spray on the little verdant glades, while overhead hoary lichens and bright festoons of elegant, long-tasselled lycopods hung from the moss-covered ancient-looking trees. Up and up we climbed the apparently endless ladder of roots and rocks. Then we passed

through a dense thicket of bamboo, and again found ourselves confronted by an ugly barrier of precipitous cliffs, which were duly surmounted with the friendly aid of tufts of tussock-grass, which firmly adhered to the crevices of the rocks. Another hour's climb up a steep, grassy glen, brought us to the crest of the highest ridge, the sky-line of which we had so long sought to reach.

Here the scene spread out to view, and the climate were such, as fully to repay us for our day of weary toil. Looking westward, we saw mapped out beneath us the plateau or basin of Milanji, with its rolling hills of grassy sward, its clearly defined belts of dark green forest, and its numerous ravines and rivulets, all shaping their course towards the principal valley of the plateau, through which the Lutshenya, the main stream, flows. The climate here was delightfully cool and bracing. During the forenoon, on the lower ridges of the mountains, at over 4,000 feet lower than this point, we had sweltered in a stifling heat of 106 degrees Fahrenheit in the shade; while here we revelled in a clear, dry, health-restoring atmosphere of 60 degrees Fahrenheit. From this ridge, which forms one of the amphitheatre of hills surrounding the plateau or crater-like basin of Milanji, a good idea of the mountain system is gained. Still looking towards the west, we have on the right hand the main peaks of the mountain, rising directly from the valley of the Lutshenya, which runs parallel with its southern base, the height of one of the two summit peaks having been calculated at 9,300 feet above sea-level. Across the table-land, in the distance, is the somewhat isolated and precipitous Tshambi range, which, with its own smaller plateau, is separated from Milanji table-land by the rocky valley and gorge of the Likabula River. To the front and to the left hand, we have a continuation of the rolling and grassy hills which encircle the plateau, and which are capped with rugged cliffs of scarped granite and gneiss rocks.

Altogether I spent two weeks on the plateau changing to three different sites, each distant from 5 to 7 miles from the other, and this enabled me to explore more thoroughly this new and interesting mountain country. Unfortunately, the rains and mists set in before I left, and, consequently, we had only nine good collecting days.

The flora of the mountain proved to be most interesting, the species met with being mostly distinct from those of the plain or even the lower slopes. But, under this heading, I must first attempt to give a short description of the cypresses—the most striking botanical feature of the plateau. The remnant left of these fine conifers is confined to a few of the upper ravines and valleys, the largest forest of them finding a comparatively secure habitat in the damp gorges of the Lutshenya valley. A few old scorched monarchs of the glen lead a precarious existence pretty well up the southern slopes of the main mountain, but unless steps are taken to protect them* these interesting relics of the past are doomed to speedy destruction. It is deplorable to witness the devastating effects of the annual bush fires, from which even this lofty and all but inaccessible retreat is not exempt. During the dry months of August and September these fires, originating from the villages on the lower slopes of the mountain, gradually creep up the precipitous cliffs from tuft to tuft of grass until at last they reach the grassy plateau. Once there, the work of destruction is rapid. The fire rages over the table-land and eats its way along the edges of the remaining belts of forest, thus annually scorching, if not burning, the

* Steps have been taken—H. H. J.

bark and timber of the outside trees, and killing outright the young seedlings. In exceptionally dry seasons it appears that these fires have even penetrated some of the damp forests, and hundreds of giant cypresses lay prostrate and piled on each other in all stages of destruction, but generally consumed right through at the base of the tree. I measured several of these dead conifers, and one (by no means the largest to be met with) was 140 feet in length and 5½ feet in diameter at 6 feet from its base, and with a clear straight stem of 90 feet in length. The cones of this species of cypress (which may be new to science) are somewhat smaller than a chestnut of the same shape, *i.e.*, longer than broad, and open into four scales or segments, each having a spur-like knob at its apex, and covering five or six winged seeds. The foliage is of the usual juniper-like description, and the timber is of a dull reddish white colour, of excellent quality and easily worked. The bark on old trees is of great thickness, consisting of layers annually shed and renewed. I selected sections of this valuable timber tree, which I hope to send home with the other Milanji specimens by an early date. Seeds of it are put in nursery beds in the Residency experimental gardens at Zomba, and I trust the tree will thrive in its new habitat here. One or two other species of *Cupressus* were met with, but of dwarf and scrubby growth.

Tree-ferns attain to a great size in the damp, shady forests of the plateau, and one I measured was 30 feet in height and 2 feet in diameter at its base. I hope to send home sections of them also.

Never before have I met with more gorgeous displays of wild flowers than those to be seen in some favoured nooks of these highlands. There we observed creamy-white and yellow helichrysums, mingling with purple and blue orchids and irises, and graceful snow-white anemones, all blooming in wild profusion, and rearing their heads from a bed of bright green grassy sward—a floral carpet, which Nature alone can fashion. Altogether we procured several thousand specimens of dried plants of many species, and which, I trust, will be of benefit to science. Many of the trees had not come into flower, and the ferns had not matured their fronds and seeds. The grass lands also had been too recently burned to permit of many of the plants reaching the flowering stage.

The year is pretty equally divided into wet and dry months, the former being from November to May. The other six months are fine, clear, and bracing, the thermometer, at night, occasionally falling below freezing point in the months of May, June, and July. I found the air delightfully pure, balmy, and bracing during October, and a good idea of the temperature will be got from the register kept on the plateau, a copy of which I enclose. During the wet months, as at all mountain sanataria in the tropics, it must be miserable and dreary. At Newera Eliya, in Ceylon, I have known a whole week to pass without a ray of sunshine; mist and rain, all the while, driving over the plain. The one great drawback to the establishing of a sanatarium at Milanji is the great difficulty in reaching it, and, in fact, it is at present quite beyond the reach of invalids. With good engineering, however, a road could be made, of fairly good gradient, viâ the Lutshenya valley, and which would also serve as an outlet for the valuable cypress timber, now lying useless and decaying in the forests.

The soil of the grass lands is of the same poor description as is generally found in tropical countries at a similar elevation, which have been subjected to the same impoverishing effects of periodical fires. They are, consequently, unsuitable for cultivation, but would be admirably adapted for cattle or sheep runs, the prevailing grasses being more

tender and nutritious than the strong rank herbage of the plains. The climate, too, would be all in favour of stock-rearing, as would also be the well-watered nature of the valleys.

As to the soil around the base of the mountain, I consider it specially well suited for the cultivation of coffee, and cacao would do well in many of the sheltered ravines along the courses of the rivers. The land generally is remarkably productive, and some gardens were pointed out to me from which the natives had reaped three crops of Indian corn and sorghum within twelve months. The total rainfall is not great, probably from 60 to 70 inches, but it would seem to be better distributed than at Zomba and other ranges in the Shiré highlands. Mr. Brown, the pioneer planter of the district, in charge of the African Lakes Company's property, informed me that during his one year's experience there had not been a single month without rain. On the plains, tobacco and cotton could be grown to an unlimited extent, and, I have no doubt, at a good profit, when better means of transport are available. Many other minor tropica products could also be raised with advantage.

(Signed) Alexander Whyte.

Milanji Plateau.

Weather Report, 6,000 feet above sea-level.—14 days.

Date.	6 A.M.	12 A.M.	6 P.M.	Remarks.
	Degrees.	Degrees.	Degrees.	
Oct. 21 -	56	61	60	Calm, sunny. Wind slight, S.E.
„ 22 -	56	62	61	Calm, sunny. Wind slight, N.E.
„ 23 -	58	65	63	Strong wind at night. Thunder.
„ 24 -	60	66	64	Calm.
„ 25 -	59	68	63	No wind. Cloudy.
„ 26 -	58	69	64	No wind. Calm. No clouds.
„ 27 -	60	67	64	No wind. Calm. Cloudy.
„ 28 -	61	66	62	Camp No. 2. at 12 A.M., 500 feet elevation above Camp No. 1. Slight rain at 7 P.M.
„ 29 -	59	70	58	Warm. Slight wind.
„ 30 -	56	70	59	Camp No. 3. at 12 A.M., 300 feet elevation above Camp No. 2. Very foggy all afternoon.
„ 31 -	52	68	56	Thick mist all day. Slight rain evening.
Nov. 1 -	54	66	54	Thick mist all day. Cold at night and morning.
„ 2 -	53	70	59	Clear fine day. Camp No. 1. 12 A.M.
„ 3 -	56	76	64	Clear fine day. Camp No. 1. Very hot.
				Sunny, 9 days; rain, — days; misty, 3 days; cloudy, 2 days.

Maximum, 67·5 degrees. Minimum, 58·5 degrees. Mean temperature, 63 degrees.

Note.—Readings, camps Nos. 2 and 3, in tent; rest in cool, damp house. Temperature at 2,300 feet above sea on 5th November, 6 A.M. 76 degrees.

(Signed) A. Whyte.

November 5, 1891.

CCXLV.—DECADES KEWENSES.

PLANTARUM NOVARUM in HERBARIO HORTI REGII CONSERVATARUM.

DECAS II.

11. **Hansemannia oblonga**, *Hemsl.* [Leguminosæ-Mimoseæ]; foliis bipinnatis pinnis unijugis, foliolis oblongis, racemis elongatis terminalibus

Arbor elegans (*Comins*), novellis ferrugineo-pubescentibus. *Folia* breviter petiolata (petiolus fere bipollicaris); foliola 4-juga, brevissime petiolulata, tenuissima, fere membranacea, cito glabrescentia, anguste oblonga, acuta, maxima semipedalia et fere 2 poll. lata (inferiora gradatim minora, infima vix bipollicaria), venis primariis inconspicuis, venulis ultimis reticulatis. *Racemi* cum pedunculo brevi circiter 8 poll. longi, densiflori, pedicellis 3–4 lineas longis. *Flores* aurantiaci (*Comins*), 9–10 lineas diametro; calyx crassus, subcoriaceus, ferrugineo-tomentosus, sæpius alte trilobatus, lobis latis fere rotundatis; corolla semipollicaris, subcoriacea, regularis, 4-lobata, extus albo-tomentosa, lobis ovato-lanceolatis vix acutis; stamina numerosissima, petala superantia; gynæcii carpella 3–5, subsessilia, pauciovulata, dense villosa, stylis graciilibus glabris quam stamina longioribus. *Legumen* ignotum.

Hab.—Malanta, Solomon Islands, *Rev. R. B. Comins*, 102.

The pluricarpellary genera of the Mimoseæ should probably all rank as sections of other genera, but it is difficult to decide their limits, and so long as one is maintained, the others must be. Bentham (Trans. Linn. Soc., xxx., p. 349) suggests that the Australian *Archidendron*, F. von Muell, would be better placed as a section of *Pithecolobium*, and the Brazilian *Affonsea*, St. Hil., as a section of *Inga;* whereas Mueller himself (Second Census of Australian Plants, p. 80) reduces *Archidendron* and half-a-dozen other genera to *Albizzia*. Kuntze (Rev. Gen. Pl., p. 158) reduces *Archidendron* to *Affonsea*. In the meantime Schumann established (Engler's Jahrbücher, ix., p. 201) his *Hansemannia*, which differs from *Archidendron* in having racemose instead of capitate flowers. Under these circumstances I prefer the course here adopted.

12. **Oxyanthus Monteiroæ**, *N. E. Brown* [Rubiaceæ]; frutex ramulis stipulis foliisque subtus pubescentibus, foliis breviter petiolatis oblongis breviter et subrepentino acuminatis, basi oblique cordatis, coriaceis supra glabris, venis primariis 8–9 costæ utrinque, stipulis late triangulari-ovatis acuminatis, floribus in paniculis axillaribus brevibus glabris brevissimo pedunculatis multifloris congestis, bracteis lanceolato-subulatis acuminatis dorso pubescentibus, calyce quinquedentato, corolla alba, tubo gracili, lobis lanceolatis acuminatis tubo octuplo brevioribus.—Monteiro, "Delagoa Bay," pp. 1 et 201.

Hab.—Delagoa Bay, *Mrs. Monteiro.*

Folia circa 3 poll. longa, $1\frac{1}{2}$–$1\frac{3}{4}$ lata, petioli $\frac{1}{4}$ poll. longi. *Stipulæ* 4–5 lin. longæ. *Calycis* dentes $\frac{1}{2}$ lin. longi. *Corollæ* tubus 2 poll. longus, lobi $\frac{3}{8}$ poll. longi.

This is very distinct in foliage from the other known species of the genus, but in its flowers and congested panicles resembles *O. Gerrardi*, Sond.

13. **Pachypodium Saundersii**, *N. E. Brown* [Apocynaceæ]; frutex succulentus caudice magno napiformi, ramis valde aculeatis glabris, foliis subsessilibus obovatis vel obovato-ellipticis subacutis, marginibus aspero-denticulatis, costa hirta excepta utrinque glabris, stipulis aculeiformibus rectis, cymis sessilibus plurifloris ad fasciculos redactis, calycis lobis late ovatis acuminatis, corolla alba roseo tincta, tubo infra medium abrupte angustato, intus piloso, lobis oblique rhomboideis acutisque.

Hab.—South Africa: South-east Bombo range of mountains, in very stony places. *Saunders.*

Rami 4–5 ped. longi. *Folia* 1½–3 poll. longa, ¾–1½ poll. lata. *Stipulæ* (*aculei*) ¼–1½ poll. longa. *Calycis* lobi ⅛ poll. longi. *Corollæ* tubus 1¼–1½ poll. longus, limbo 2–2½ poll. diam.

This very distinct species was discovered by Mr. Charles Saunders, and forwarded to Kew by Mrs. K. Saunders, with the following extract from her son's letter concerning it:—"I came upon a most peculiar plant when first we came here, not then in flower. Now it has a very pretty and delicate white bloom just like wax, each petal tinged with a delicate pink. It grows among the stones, and just above the ground forms a large kind of ball-shaped stem. From that it throws out branches covered with thorns about an inch long, some of the shrubs growing about four or five feet high. The stems are very succulent, like a geranium." The exact locality is not stated, so whether it grows on the Zululand and Amatonga side or the Swaziland side of the range is uncertain.

14. **Strophanthus petersianus**, Klotzsch, var. *grandiflorus*, *N. E. Brown* [Apocynaceæ]; foliis et floribus multo majoribus ab typo tantum differt.—Monteiro, "Delagoa Bay," pp. 47 et 164.

Hab.—Rises north side of Limpopo River, *Erskine*: Delagoa Bay, *Mrs. Monteiro*, 1: Zanzibar, *Dr. Kirk:* Mombasa, *Hildebrandt*, 1976.

Folia 1½–3 poll. longa ¾–2 poll. lata; petioli ⅜ poll longi. *Calycis* segmenta ½ poll. longa. *Corollæ* tubus ampliatus 1 poll. longus et latus; lobis 5–7 poll. longis, reflexis.

I can find no characters to distinguish this plant from the typical *S. petersianus*, except the larger leaves and flowers, and these differences are possibly due to the greater humidity of the coast region where this variety grows, the typical form being a native of the inland region at Tette. It is interesting in having such an extensive range, the northern and southern localities being 20 degrees of latitude apart. When in flower it must be very ornamental and well worth cultivating; the label on Mrs. Monteiro's specimen states that it "grows in the thick scrub, with long branches, forming dense bushes 5 to 6 ft. high. Flowers white inside, maroon outside." A sketch in the Kew Herbarium represents the flowers as purple outside and white within, marked with some orange lines in the tube. The flowers stand erect, the lobes of the corolla being reflexed and their long slender tails pendulous. A second variety (var. *amboensis*) is described by Dr. Schinz in *Verhandlungen Bot. Ver. Prov. Brandenburg*, 1889, vol. 30, p. 259, from Amboland, on the western side of the continent.

15. **Hoya affinis**, *Hemsl.* [Asclepiadeæ]; *H. Guppyi* arcte affinis, differt foliis oblongis paucinervis, petiolis crassioribus, floribus majoribus intus fere glabris extus pubescentibus.

Rami subcarnosi, parcissime puberuli, cito glabrescentes. *Folia* carnosa, longe petiolata, oblonga vel elliptica, absque petiolo 3–4 poll. longa, breviter acuminata, basi rotundata, nitida, supra secus costam primum parce puberula; petiolus crassissimus, 12–15 lineas longus. *Flores* subumbellati, fere 1½ poll. diametro, umbellis paucifloris axillaribus breviter pedunculatis, pedicellis graciliusculis circiter sesquipollicaribus; sepala parva, ovato-oblonga, subobtusa, extus pubescentia; corolla crassa, carnosa, rotata, extus puberula, lobis deltoideis patentissimis; coronæ squamæ cartilagineæ vel fere crustaceæ, nitidæ, ovoideæ. *Folliculi* desunt.

Hab.—Florida, Solomon Islands, *Rev. R. B. Comins*, 57.

16. **Clerodendron congense**, *Baker* [Verbenaceæ]; fruticosum, erectum, ramulis gracilibus glabris, foliis oppositis brevissime petiolatis oblongis vel obovatis integris cuspidatis glabris, floribus pluribus in cymis congestis terminalibus globosis pedunculatis aggregatis, calycis glabri segmentis ovatis tubo oblongo brevioribus, corollæ tubo cylindrico glabro recto calyco multo longiori, lobis obovatis parvis subequalibus, staminibus lobis triplo longioribus.

Hab.—Congo Free State: Banks of the river below Stanley Pool, *H. H. Johnston*.

Folia 4–6 poll. longa. *Calyx* 2 lin. longus. *Corollæ* tubus 12–15 lin. longus; segmenta 2 lin. longa. *Filamenta* 6–8 lin. longa, antheris parvis.

This fine species, one of the first fruits of the botany of the Congo Free State, is nearly allied to *C. sinuatum*, Hook., in Bot. Mag., t. 4255, a plant of Sierra Leone. The colour of the flower is probably white. The expanded heads are four inches in diameter.

17. **Eulophia dispersa**, *N. E. Brown* [Orchideæ]; foliis lineari-lanceolatis acutis; scapo vaginis 2–4 ovatis acutis distantibus instructo; bracteis lanceolato-subulatis; floribus numerosis speciosis luteis, sepalis ovatis acutis valde reflexis, petalis multo majoribus ellipticis obtusis, labello hastato-oblongo obtuso, breviter calcarato, disco distincte tricarinato cum carinis 2–3 minus elevatis utrinque.—Monteiro, "Delagoa Bay," p. 174 and figure on title page.

Hab.—Delagoa Bay, *Mrs. Monteiro*: Shupanga, Zambesi Expedition, *Dr. Kirk*: Morambalia, Livingston's S. African Expedition, *Dr. Kirk*: Banks of Zonga River near Lake Ngami, *McCabe*: Ribe, *Rev. T. Wakefield*: Zanzibar, *Dr. Kirk*: Lake Nyassa.

Folia 1½–2 ped. longa, $\frac{5}{8}$–1 poll. lata. Scapus 2–4 ped. altus, vaginis 1–1¾ poll. longis. Flores 2 poll. diam.; sepalis ⅜ poll. longis, petalis ¾–1 poll. longis, ½–¾ poll. latis, labello ¾–1 poll. longo, ⅜–½ poll. lato, calcare ⅛–¼ poll. longo.

This plant is allied to *E. speciosa*, but differs in being less stout in habit, with narrower bracts, and especially in having well marked keels on the lip. Mrs. Monteiro describes the flowers as "yellow with white centre streaked with crimson, sweet scented." A coloured sketch from Dr. Kirk represents the flower as yellow with orange keels. Probably the flowers vary in colour, as is the case in some other species of this genus. I can find no difference in the flowers themselves from the different localities mentioned.

18. **Pseudomacodes**, *Rolfe* [Orchidearum Genus Novum]. Sepala subæquali, libera, patentia. Petala angusta, cum sepalo postico in galeam conniventia. Labellum basi columnæ adnatum, late ventricosum, intus

bicallosum; lobi laterales parvi, erecti; lobus medius unguiculatus, ungue crenulato, lamina parva ovato-rotundata. Columna brevis, antice sub stigmate in laminam tenuem producta; stigma carnosa, sub rostello elongato bifido prominens; clinandrium membranaceum, cum rostello in cyathum connatum. Anthera acuminata, loculis contiguis sed vere discretis; pollinia sectilia, anthera dehiscente stipiti brevi a glandula parva affixo.

P. **Cominsii**, *Rolfe*, terrestris, foliata, rhizomata repente, habitu *Anæctochili*. Folia late elliptico-ovata, breviter acuminata, insigniter venoso-picta, 2–4½ poll. longa, 1–3 poll. lata, petiolus 1–4 poll. longus. Scapus erectus, pubescens, circa pedem longus, racemo elongato multifloro. Sepala late ovato-oblonga, subobtusa, fere 3 lin. longa, 2 lin. lata. Petala linearia, quam sepala paullo breviora. Labellum fere 3 lin. longum, basi subgloboso-ventricosum.

Hab.—San Cristoval, Solomon Isles, *Rev. R. B. Comins*, 116. "Low plant, very succulent, handsome, leaves red and green. Native name 'Kanora.'" Colour of flowers not recorded.

A new genus with the habit and general appearance of *Macodes*, Blume, but differing therefrom in its large fleshy stigma, and in the possession of a large and thin plate-like appendage in front of the column, instead of a pair of parallel ones, in which latter respect it differs from every one of the allied genera, so far as I can ascertain. Moreover in *Macodes* these appendages descend into the sac of the lip, somewhat as in *Dossinia*.

19. **Amomum** (**Achasma**) **Ridleyi**, *Baker* [Scitamineæ]; caule foliifero robusto longissimo foliis sessilibus oblongis basi rotundatis, florum capitulis subsessilibus oblongis, bracteis oblongis, corollæ tubo cylindrico bracteis æquilongo, segmentis parvis lingulatis rubris, stamina corollæ segmentis vix breviori antherâ magna lineari hirsuta.

Hab.—Singapore, *Ridley* 96 !

Caulis foliiferus 10-pedalis et ultra. *Folia* 15–18 poll. longa, 3–4 poll. lata. *Bracteæ* 2 poll. longæ. *Corollæ* segmenta 8–9 lin. longa.

Ab Griffithii speciebus tribus cognitis differt corollæ lobis multo minoribus.

20. **Æchmea** (**Platyæchmea**) **Nichollsii**, *Baker* [Bromeliaceæ]; foliis loratis subcoriaceis apice rotundatis mucronatis facie glabris dorso tenuiter lepidotis aculeis marginalibus parvis crebris ascendentibus, pedunculo elongato, floribus spicato-paniculatis, bracteis primariis parvis lanceolatis reflexis, spicis distichis pedunculatis, bracteis floriferis geminis, exteriori oblongo-naviculari, interiori breviori ad axin adnato, sepalis coriaceis minute cuspidatis, petalorum laminis parvis.

Hab.—Island of Tobago, on trees in the woods, *Dr. H. A. Alford Nicholls*.

Folia bipedalia, medio 2 poll. lata, basi dilatata oblonga 8 poll. longa, 4 poll. lata. *Spicæ* 3–4 poll. longæ, 1 poll. latæ. *Calyx* 1 poll. longus.

Habitus *Æ. lingulatæ*, Baker (*Bromelia lingulata*, Linn), sed spicis distichis longioribus distincte pedunculatis.

CCXLVI.—SANSEVIERIA FIBRE FROM SOMALI-LAND.

(*Sansevieria Ehrhenbergii*, Schwein.)

The increased attention devoted to the production of white rope fibres in the Western tropics appears to have had a stimulating effect also in the East Indies. The production of fibre from *Agave vivipara* in Bombay and Manila is now followed by a fibre obtained from Somali-land from a singular species of *Sansevieria*. This fibre was first received in this country as an "Aloe" fibre. It was soon noticed, however, that it possessed characteristics differing from all ordinary "Aloe" fibre, and an inquiry made by this establishment through the Foreign Office has shown that it is one of the many so-called Bow-string Hemps, and probably yielded by *Sansevieria Ehrhenbergii*, a plant first collected by Dr. Schweinfurth, and of which little or nothing was known until it was described by Mr. J. G. Baker, F.R.S., in *Journal of the Linnean Society*, xiv. p. 549. Its locality is there stated as "between Athara and the Red Sea." The details in regard to its utilisation as a fibre plant are contained in the following correspondence :—

ROYAL GARDENS, KEW, TO FOREIGN OFFICE.

Royal Gardens, Kew, March 29, 1892.

I AM directed by Mr. Thiselton-Dyer to acknowledge the receipt of a copy of a Report on the Aloe Fibre of Somali-land, [Foreign Office Miscellaneous Series, No. 225, 1892,] communicated to this establishment.

2. This Report is of an interesting character. It would be desirable to obtain a small sample of the fibre for the Museums of Economic Botany at Kew.

It would be useful also to obtain a large leaf from the plant yielding the fibre and, if possible, a few small plants for growing in the Kew collection.

The leaf and young plants would travel very well in a dry box without any packing, and provided with holes in the sides for ventilation.

3. Mr. Thiselton-Dyer trusts that the Secretary of State will approve of the kind offices of Lieutenant-Colonel Stace being invited to obtain the specimens mentioned, and I am to add that this establishment will be prepared to pay any reasonable expenses that may be incurred.

I have, &c.

(Signed) D. MORRIS,
Assistant Director.

Sir Villiers Lister, K.C.M.G.,
Foreign Office.

Sir E. BARING to the MARQUIS OF SALISBURY.

MY LORD, Cairo, February 17, 1892.

I HAVE the honour to forward herewith to your Lordship a Report by Lieutenant-Colonel E. V. Stace, Her Majesty's Consul at Aden, regarding the Aloe Fibre of the Somali Coast Protectorate.

I have, &c.

(Signed) E. BARING.

Aloe Fibre in Somali-land.

Lieutenant-Colonel E. V. Stace to Sir E. Baring.

Sir, Aden, January 31, 1892.

I have the honour to make the following report regarding the Aloe Fibre of the Somali Coast Protectorate, my object being that, should there be no objection, the subject might be brought to the notice of the various Chambers of Commerce in England, with a view to the possible development of a useful industry which would be beneficial to the people, and might be a source of revenue to the Government.

2. In November last a bale of the fibre was sent to the Government of Bombay. This was sent to England, and the reports have just been received. I must state here that the fibre was prepared in the roughest and rudest manner by ignorant Somalis in the manner described in the accompanying copy of a memorandum which I wrote on November 22nd last, yet the price obtained was, I think, a very fair one, and might be considerably increased if the fibre were properly prepared.

3. The report of the Bombay Company (Limited) on the fibre sent by the Government of Bombay states that it was sold at the rate of 16*l.* 10*s.* per ton. "Our London brokers valued the parcel at about the same "price, and it is pretty evident that in larger quantities this article "would meet with a ready sale." And again, "This fibre compares "favourably with the many new types we see from various countries, "which are frequently too poor in colour, or too short, brittle, and full "of pith. Yours is of good strength, very nice colour and length."

The brokers further reported the fibre "all very nice colour, and good "strength and clean . . . . . This seems a very saleable article if "once introduced."

4. I need scarcely say that the small quantity sent was very much against a better price being obtained; the sale was by auction of what was really but a sample.

5. There are vast quantities of the Aloe growing in Somali-land. The people themselves will do nothing towards making a trade in the fibre; indeed, they have not the means to work it profitably, though they use it extensively themselves for ropes and other articles. I have a specimen growing here (Aden) over 7 feet in length, though I admit that this is exceptional; still I am informed that the wild plant might be materially improved. I have no knowledge whatever myself on the subject, but I have thought that if the existence of the plant and value of the fibre be made known in England through the Chambers of Commerce, it is possible that some persons with experience might be induced to make the necessary inquiries regarding a profitable production of the fibre.

I have, &c.
(Signed) E. V. Stace.

P.S.—The specimen mentioned in paragraph 3 of the attached memorandum, as "sent to England," was merely a small hand-parcel. The larger parcel sent through the Government of Bombay was the one reported on by the brokers, as mentioned in this letter above.

Memorandum regarding the Aloe Fibre of Somali-land.

The following is gathered from various sources in England and Somali-land. I have never seen the fibre prepared myself.

2. The plant is not cut, it is pulled out of the ground—the sharp points are cut off; the plant is then divided in two down the centre; the pieces are then beaten with a stick until they become soft. The fibre is then extracted by placing the divided plant between two pieces of wood, which are fastened tightly together, and the plant is pulled through them, leaving the fibre. This is then placed in the sun to dry for about half an hour. No water is used; the Somalis say that that blackens the fibre. The plant should be treated as soon as possible after being pulled up to prevent the drying of the sap.

3. Regarding a specimen of the fibre sent to England (similar to that sent to Bombay), it was considered that the fibre should be whiter, and that it was rather short; but that any quantity of the same as sent would be well received, and it was valued at 21*l.* to 22*l.* per ton. It wanted more bleaching in the sun and washing in water, and should be well cleaned.

Death's patent fibre cleaning machine costs about 70*l.*; it requires either water-power or a 5 horse-power steam-engine of English make to drive it; this costs 150*l.*

If the aloe is left lying for a day or two in the sun it ruins it; it should be treated at once, and under sheds.

4. I know of no water-power within any reasonable distance of the coast.

5. There appears to be any amount of aloe within reasonable distance. I have heard that it would be much improved by being properly cultivated, such as thinned in places where it is growing too thickly.

6. Labour is obtainable at the seaport towns, but the Somali is extremely lazy, and it might be necessary to import Arab labourers at first, though regular employment for the Somalis, who swarm as idlers about the ports, would be very desirable.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

SIR, Royal Gardens, Kew, June 27, 1892.

I am desired by Mr. Thiselton-Dyer to inform you, in reference to my letter of the 29th March last, that a case containing young plants, stems, leaves and fibre from Somali-land has been received at Kew from Lieutenant-Colonel E. V. Stace, C.B., Political Agent and Consul at Aden.

The specimens arrived in excellent order, and they have enabled us to determine very readily that the plant yielding the new fibre from Somali-land is not an "Aloe" or Agave like that yielding Bombay Aloe fibre. The plant is a *Sansevieria*, one species of which (*Sansevieria zeylanica*) yields the well-known Bow-string hemp of India (*Kew Bulletin*, May 1887, pp. 1–11). The Somali-land plant is probably *Sansevieria Ehrhenbergii* of Schweinfurth, described in the *Journal of the Linnean Society*, vol. xiv. p. 549, and known only from very imperfect material. The leaves are stout and sub-cylindrical, terminating in a strong spine. They are solid throughout, and are 4 to 5 feet in length and, according to Lieutenant-Colonel Stace, under exceptional circumstances they attain a length of about 7 feet. The circumference of fresh leaves at the base would be about 5 to 7 inches. The flowers have not yet been received. The plant is altogether a very interesting one, and its existence as a source of a valuable supply of fibre is a fact that will be sure to awaken attention amongst commercial men in this country.

Mr. Thiselton-Dyer desires to express his thanks to the Secretary of State for the prompt manner in which his wishes have been met in this matter, and he would venture to ask that the obligations of Kew be conveyed to Lieutenant-Colonel Stace for the admirable way in which he forwarded the specimens to this country.

I have, &c.

(Signed) D. Morris,
Assistant Director.

Sir Villiers Lister, K.C.M.G.,
Foreign Office.

Messrs. Ide and Christie, to Royal Gardens, Kew.

72, Mark Lane, London,
June 27, 1892.

Sir,

We duly received your favour of the 18th instant, accompanying a sample of fibre from a plant known as the "Aloe of Somali-land."

This is an excellent fibre of fair length, and with plenty of "life." In character it strongly resembles the best Sisal hemp, with which we should have classed it, but for your statement that it is derived from a *Sansevieria*.

With the exception of its colour, its preparation is perfect, and even as it is, we value it to-day at 25*l*. per ton. We are of opinion that if care were taken to improve the colour, a considerably higher price would be readily obtainable, perhaps as much as 50*l*. per ton, if a pure white fibre could be attained without loss of strength and lustre.

Yours, &c.

(Signed) Ide and Christie.

D. Morris, Esq., M.A., F.L.S.,
Royal Gardens, Kew.

CCXLVII.—PARAGUAY TEA.

(*Ilex paraguariensis*, St. Hil.)

The Paraguay tea or *Yerba de Maté* is one of the most important economic products of South America. There are several varieties and possibly more than one species of *Ilex* yielding this tea. The plants are found in Brazil and Paraguay, and they are extensively used by the whole population of South America. The active principle found in the leaves is the alkaloid known as caffein, identical with that found in tea and coffee. There is also, according to Dr. T. Cranstown Charles (who published a note on the subject in the *British Medical Journal*, July 1890, p. 203), a tannic acid present in large amount. Further, "although *maté* is closely allied to coffee, it yields up its active principle "in a different way, and it is slower than coffee in yielding up its "nutritious principles to boiling water."

In the preparation of *maté*, the leaves are scorched and dried while still attached to the branches brought in by the collectors, they are then beaten, separated, coarsely ground by rude mills, and packed in skins and leather bags. The leaves are infused in small tea-pots, and the tea is sucked through a bombilla or tube with wire net-work or perforations

at the bottom. The consumption of *maté* in South America is very extensive; upwards of five million pounds are exported from Paraguay alone.

The following notes on the botany of plants yielding Paraguay tea have been prepared by Mr. N. E. Brown, A.L.S., one of the assistants in the Kew Herbarium. They show that considerable confusion has arisen in regard to the identification of the original species described by St. Hilaire, and this confusion has extended to cultivated specimens grown in this country and elsewhere. Some of these have proved to be a species of *Symplocos* and another a species of *Elæodendron*. Mr. Brown's investigations will unable us to unravel some at least of the difficulties brought about by the writings of Miers, who, at the time, had not seen the type of St. Hilaire's species.

Notes on certain Plants yielding Paraguay Tea.

The question having arisen as to whether the plant cultivated at Kew, and probably elsewhere, under the name of "Paraguay Tea" was the true *Ilex paraguariensis* of St. Hilaire or some other species, has caused me to examine some of the South American species of Ilex, and to compare the Kew material with the types of D. Don and Miers, which are now preserved in the British Museum Herbarium; the following being the result of my investigations:—

When Miers wrote his account of the "Paraguay Tea" plants,* he had not seen the type of St. Hilaire's species, and states that it was either lost or mislaid in the Paris Herbarium; the latter would appear to have been the case, as a set of duplicates of St. Hilaire's collection has recently been received at Kew from the Paris Herbarium, and among them are two shoots of *Ilex paraguariensis*, St. Hil.! from the province of Minas Geraes. These prove to be specifically identical with the plant figured and described by Don as *Ilex paraguensis* in the appendix to Lambert's *Description of the genus Pinus*, as indeed is distinctly stated by St. Hilaire himself in his *Voyage dans le district des Diamans*, vol. 1, p. 273. On referring to Miers' types, I find that *I. paraguayensis*, vars. *dentata* and *usitata*, Miers, and *I. curitibensis*, var. *gardneriana*, Miers, also belong to this species, for between the three plants to which Miers applied these three names I can find absolutely no distinction except as to sex. St. Hilaire's specimens received at Kew are vigorous young shoots with very large leaves, and have neither flowers nor fruit, but there can be no question as to their identity with the specimens above mentioned; the toothing of the leaves varies considerably, one shoot having much more finely toothed leaves than the other shoot has; and from these and other specimens at Kew it is easy to see that the typical *I. curitibensis*, Miers, is a slight form of the same plant with the tips of the leaves a little more prolonged. Two leaves on one of St. Hilaire's specimens are very similar to the two lower ones represented on Miers' plate of *I. curitibensis*, and the foliage of the right-hand fruiting branch figured in Hooker's *London Journal of Botany*, 1842, vol. 1, t. 1, obtained from the Horticultural Society, as mentioned on p. 31 of the Journal, closely agrees with the smaller leaves of Miers' type of *I. curitibensis*, but the teeth are not quite so deeply cut; it

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* *Annals and Magazine of Natural History*, 3rd ser. vol. 8, p. 389; and *Contributions to Botany*, vol. 2, p. 99.

appears to me fairly intermediate between *I. paraguariensis* and *I. curitibensis*, and has leaves very similar to both forms on the same twig, so that I believe St. Hilaire was perfectly correct in considering the Curitiba and Paraguay plants to be one and the same species, although the quality of the tea prepared from each may be different, as stated by Miers. The left-hand branch (from Tweedie) figured on the plate in the *London Journal of Botany* just quoted, is a small leaved specimen of the true *I. paraguariensis*. The plant which Miers considered to be the type of the "real Paraguay species" (Bonpland, No. 596), I do not match with any specimen in the Kew Herbarium, but his type specimen is accurately represented on pl. 61 of his *Contributions to Botany*; the leaves are nearly but not quite entire, the younger part of the stem is sparsely and minutely pubescent, a character not mentioned by Miers, and by which it differs from all his other specimens except *I. paraguayensis*, var. *idonea*, which also has pubescent shoots and petioles, and rather more oblong leaves; the peduncles and pedicels too, of Miers' typical form, are very slender, just as represented on his plate. But although these differences may indicate a different variety, I think it probable that all are forms of but one species. Turning to the species described by Reisseck in the *Flora Brasiliensis*, I should place *I. domestica*, var. *glabra*, under typical *I. paraguariensis*; his typical *I. domestica* (which is identical with *I. vestita*, Reiss.) is a very closely allied plant, differing in no respect except pubescence, so far as I can see, from *I. paraguariensis*; and *I. sorbilis*, Reiss. I believe to be the same plant, but I have not seen an authentic specimen.

None of these forms are the same as the plant now cultivated at Kew as *Ilex paraguariensis*, that plant being *I. nigropunctata*, Miers, a perfectly distinct species, and more nearly allied to *I. affinis*, Gardn. than to *I. paraguariensis*, St. Hil.

Of the other species described by Miers as being used for Paraguay Tea, the following is the synonyny. *I. gigantea*, Bonpl. is the same as *I. fertilis* Reiss. and must give place to the latter name. *I. amara*, Bonpl. is *Symplocos lanceolata*, A. DC.! It will be interesting to know if this plant really yields theine, but it is enumerated by Bonpland among the species employed for making Maté, see Miers *Contributions* vol. 2, p. 99. Miers' type is without flower or fruit, being a young vigorous twig with deeply toothed leaves. I at once recognised it as a species of *Symplocos*, and on looking at the Kew material found my identification fully confirmed by two leaves from a specimen sent by Bonpland to Prof. Muenter many years ago, and communicated to Kew by Dr. Goeze in 1882, with the following information:—"Some "twenty or thirty years ago M. Bonpland sent dried specimens of Ilices "to M. Muenter, out of which the Paraguay Tea is prepared. Amongst "others there is one plant which Bonpland called '*Cauna de Campo*,' "and which according to Bonpland is on behalf of its beautiful yellow "colour, taken with preference for the *Yerva Maté*. Muenter believes "this not to be a true Ilex. Bonpland in his diagnosis says * * *" Here follows a description, concluding with "Crescit in montibus Sta. Cruz (Brazil)." This is the locality given by Bonpland for his *I. amara*, and the leaves sent to Kew by Dr. Goeze belong to the same plant, but are from a flowering shoot and less strongly toothed than in Miers' specimen, and certainly belong to *Symplocos lanceolata*, A. DC. A note on this plant will be found in Prof. Muenter's article on Maté plants, published in 1883 in *Mittheil. Naturwissensch. Ver. Neu-Vorpomm.* vol. 14, p. 203, or in the reprint, p. 101, but Prof. Muenter did not identify it with *Ilex amara*, Miers.

I. humboldtiana, Bonpl. is a perfectly distinct species from *I. paraguariensis*, of which Reisseck makes it a variety, and is not at all difficult to recognise.

I. ovalifolia, Bonpl. is very closely allied to *I. humboldtiana*, and may perhaps be a form of that species, but the leaves are shorter, and broader in proportion to their length.

The plant figured in the *Botanical Magazine*, t. 3992, as *Ilex paraguayensis* is clearly not an Ilex at all, but a member of the order *Celastrineæ*, but after going through the whole of the *Celastrinæ*, and the American species of Ilex contained in the Kew Herbarium, I have been unable to find a specimen of the plant figured, but I think it is most probably *Elæodendron quadrangulatum*, Reiss.

Set out in tabular form the synonyny of the Paraguay Tea plants discussed by Miers appears to be as follows :—

1. Ilex paraguariensis, *St. Hil. in Mem. Mus. Hist. Nat.* vol. 9, p. 351 (1822); *Spach, Hist. Nat. Veg. Phan.* vol. 2, p. 430, *Atlas* pl. 16; *Münter in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 181; and reprint, p. 79.

I. paraguensis, *Don in Append. to Lambert Descript. of the genus Pinus* t. 2 (1824); *Hook. Lond. Journ. Bot.* 1842, vol. 1, p. 35, t. 1.

I. mate, *St. Hil. Hist. Plant. remarq. Brésil et Parag. Introduct.* p. xli. (1824).

I. domestica, *Reiss. var.* glabra, *Reiss. in Fl. Bras.* vol. 11. part 1, p. 67 (Feb. 1861).

I. paraguayensis, *var.* dentata, *Miers*, and var. usitata, *Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 392-393 (Nov. 1861); and *Contrib. Bot.* vol. 2, p. 102–103, pl. 62.

I. curitibensis, *Miers*, and *var.* gardneriana, *Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 393–4; and *Contrib. Bot.* vol. 2, p. 103–104, pl. 63.

Paraguay: *Tweedie! Balansa! Bonpland!* R. Parana between 26° and 27° S. lat. *Paradi!* South Brazil: *Lobb* No. 34! *Sellow! Reidel!* Organ Mountains, *Gardner* No. 346! *Glaziou* No. 6123! Province of Minas Geraes, St. Hilaire, No. 785! Kew and British Museum Herb. A plant collected by *Regnell* at Caldas in the province of Minas Geraes (No. I. 50) I believe to be a northern form of this plant, the leaves are the same, but the very short flowering axis is pubescent and bears more flowers, it is distributed as "*I. sorbilis* Reiss?"

The following I believe to be merely pubescent forms of the typical *I. paraguariensis*, St. Hil.

a. I. vestita, *Reiss. in Fl. Bras.* vol. 11, part 1, p. 54, t. 12, f. 11.
I. domestica, *Reiss. in Fl. Bras.* vol. 11, part 1, p. 67, t. 14, f. 2.
I. sorbilis, *Reiss.? in Fl. Bras.* vol. 11, part 1, p. 66, t. 14, f. 1.
South Brazil: *Sellow! Morong* No. 636! Kew Herb.

b. I. paraguayensis, *Miers* and *var.* idonea, *Miers, in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 391–392; and *Contrib. Bot.* vol. 2, p. 101–102, pl. 61.
I. bonplandiana, *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm*, vol. 14, p. 183, t. 1, f. 1 and 3–8; and reprint, p. 81.

I. theæzans, *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 389 and 391; and *Contrib. Bot.* vol. 2, p. 99 and 101.

Province of Corrientes: In a wood planted by Jesuits at Candelaria, *Bonpland* No. 596! Herb. British Museum. This is possibly only a more entire leaved state of the preceding form (*I. vestita*), but I have seen no specimens exactly like those of Bonpland, and it would seem that Bonpland considered this plant to be the same as the typical glabrous-stemmed form of *I. paraguariensis*, since there is a specimen of the latter in the Kew Herbarium labelled—"Given to Mr. Fox by M. Bon-"pland (on his return from Paraguay), under the name '*Ilex theæzans*—"*Maté du Paraguay.*'"

The *I. bonplandiana*, Münt., is evidently in every way identical with Miers' var. *idonea*, which Miers states was sent with No. 596 by Bonpland, and I have very little doubt is merely a vigorous shoot of the same plant. Münter appears to have misunderstood Miers' statement that the leaves were "obsoletely dentated."

It is not improbable that these different forms may produce different qualities of tea, as stated by Miers, but I do not think they are specifically distinct; more ample material, however, together with careful observations made in their native country, is needed to definitely settle whether these forms are really one or more species.

2. **Ilex fertilis**, *Reiss. in Fl. Bras.* vol. 11, part 1, p. 42, t. 11, f. 3 (Feb. 1861).

I. gigantea, *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 394 (Nov. 1861); and *Contrib. Bot.* vol. 2, p. 104, pl. 64; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 186, t. 1, f. 2, 9, 10, 11; and reprint, p. 84.

S. Brazil: *Sellow!* Kew Herb. Province of Rio Grande: Santa Cruz, *Bonpland!* and Province of Entrerios: Banks of the River Parana, *Bonpland!* British Museum Herb.

3. **Ilex humboldtiana**, *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 395; *and Contrib. Bot.* vol. 2, p. 105, pl. 65, f. A; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 190; and reprint, p. 88.

I. crepitans, *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 395; *and Contrib. Bot.* vol. 2, p. 105; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 191, t. 2, f. 5, 6; and reprint, p. 89.

I. paraguariensis *var.* angustifolia, *Reiss. in Fl. Bras.* vol. 11, part 1, p. 63, t. 13, f. 17.

Brazil: *Lobb* No. 33! *Burchell* No. 3381! Kew Herb. Province of Rio Grande: Mountains of Santa Cruz, *Bonpland!* British Museum Herb.

4. **Ilex ovalifolia**, *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 396; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 195; and reprint, p. 93.

I. paraguariensis *var.* acutifolia, *Mart. Syst. Mat. Med.* p. 61.

I. paraguariensis *var.* longifolia, *Reiss. in Fl. Bras.* vol. 11, part 1, p. 62, t. 13, f. 16, and t. 20.

I. brevifolia, *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 195, t. 2, f. 1–4; and reprint, p. 93.

Brazil: *Burchell* No. 3115! *Gomes! Sellow* Nos. 383! 4633! Rio Janeiro, *Glaziou* No. 7573! Kew Herb. Province of Rio Grande:

Fraxinal, and towards Rio Pardo, *Bonpland* No. 2425! Rio Janeiro, *Richard.* British Museum Herb.

5. **Ilex nigropunctata,** *Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 397; and *Contrib. Bot.* vol. 2, p. 107, t. 66; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 198; and reprint, p. 96.

I. paraguayensis *var.* γ, *Hook. Lond. Journ. Bot.*, 1842, vol. 1, p. 33 (p. 35 by error), t. 3.

I. affinis *var.* angustifolia, *Reiss. in Fl. Bras.* vol. 11, part 1, p. 70, t. 14, f. 9.

Brazil: *Riedel!* Botanic Gardens, Rio de Janeiro, *Miers* No. 3899! Kew and British Museum Herb.

This is the plant now in cultivation at Kew.

The two following do not belong to the genus Ilex.

Symplocos lanceolata, *A. DC. Prod.* vol. 8, p. 253; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 203; and reprint, p. 101.

Ilex amara, *Bonpl. ex Miers in Ann. and Mag. Nat. Hist.* 3rd ser. vol. 8, p. 395; and *Contrib. Bot.* vol. 2, p. 105, pl. 64, f. B; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 189; and reprint, p. 87.

Brazil: *Martius* No. 723! Province of Minas Geraes, *Claussen!* Mountains of Santa Curz, *Bonpland!* Serra de São José, *Glaziou*, No. 16246! Environs of Rio Janeiro and D'Ouro Preto, *Glaziou*, No. 14528! Kew Herb. A specimen from *Bonpland* also in the British Museum.

Elæodendron quadrangulatum, *Reiss. in Fl. Bras.* vol. 11, p. 33, t. 5, f. 1 and 2.

"Celastrus quadrangulatus, *Schrad. in Goett. Anz.* 1821, p. 716."

"Ilex acutangula, *Nees in Flora* 1821, vol. 1, p. 329; *Hook. and Arn.* in *Hook. Bot. Misc.* vol. 3, p. 171; *Münt. in Mittheil. Naturwiss. Ver. Neu-Vorpomm.* vol. 14, p. 199; and reprint, p. 97."

Ilex paraguayensis, *Hook. in Bot. Mag.* t. 3992.

I have seen no specimen of this plant, but believe the above to be its correct synonymy.

N. E. Brown.

CCXLVIII.—NEW ORCHIDS: DECADE 2.

11. **Pleurothallis subulata,** *Rolfe, n. sp.*—Caules graciles. Folia cordato-oblonga, apice attenuata, subobtusa, 4½ poll. longa, 1½ poll. lata. Flores solitarii. Spatha lanceolata, 6 lin. longa. Pedicellus 6–7 lin. longus. Sepalum posticum ovato-oblongum, acutum, 6 lin. longum, 4 lin. latum. Sepala lateralia omnino connata, ovato-oblonga, subacuta, postico æqualia. Petala subulata, 3 lin. longa. Labellum subpandurato-ovatum, acutum, 3 lin. longum, 1¼ lin. latum. Columna brevis.

A species belonging to Lindley's section *Macrophyllæ fasciculatæ*, which flowered in the collection of Baron Hruby, of Peckau, Bohemia, and was sent to Kew for determination through Messrs. F. Sander & Co., of St. Albans. Lindley separated the species with flowers over half an inch long from those with smaller flowers, under the name *Grandifloræ*, and into this group the present species would fall. But I believe this arrangement is purely artificial, and were it abolished, *P. subulata* would be placed near to *P. cardiothallis*, Rchb. f., which it closely resembles in several respects, though its flowers are far larger. Like several of its allies, it has flowers of a dark lurid purple. Its native country is not recorded. The name refers to the petals.

12. **Restrepia ecuadorensis**, *Rolfe*, *n. sp.*—Caules 3–4 poll. longi, vaginis ancipitibus vestiti, unifoliati. Flores fasciculati, pauci, heterochronici. Bracteæ oblongo-lanceolatæ. Pedicelli graciles, 2 poll. longi, apice unibracteati. Sepalum posticum basi lanceolatum, medio subulatum, apice clavatum, 1 poll. longum. Sepala lateralia omnino connata, cucullata, 10 lin. longa, 4 lin. lata. Petala sepalo postico similia, minora, 9 lin. longa. Labellum subpandurato-ligulatum, emarginatum, fimbriato-denticulatum, papilloso-muriculatum, juxta basin utrinque cirratum, 4½ lin. longum, cirri ½ lin. longi. Columna gracilis, apice clavata, 2½ lin. longa.

Closely allied to *R. antennifera*, Kunth., but differing in the shorter lateral sepals, and in various other floral details. It is said to be a native of Ecuador, and was sent to Kew for determination by Messrs. F. Sander & Co., of St. Albans. The dorsal sepal and petals are pellucid white, lined with maroon at the base, the former with a yellow tip, the latter with purple ones. The lateral sepals are very densely spotted with maroon on a pale ground, the spots becoming suffused on either side near the base. The lip is similarly spotted on a yellow ground, but near the base the spots become of a clear purple shade, and the apex is covered with small papillæ with yellow points; the basal bristles are also yellow. The pallid column has a very deep maroon blotch near its base and a deep yellow eye-like spot on either side of the insertion of the lip.

13. **Restrepia Shuttleworthii**, *Rolfe*, *n. sp.*—Cæspitosa, circa 3–4 poll. alta. Caules graciles, laxe vaginati, foliis æquales; vaginæ conduplicatæ, lanceolatæ, acutæ, 6–9 lin. longæ. Folia ovato-oblonga, apice tridenticulata, carnosa, 1¼ poll. longa, 6–10 lin. lata. Flores solitarii; pedicelli ½ poll. longi. Bracteæ spathaceæ, apice subacutæ, 2 lin. longæ, purpureo-maculatæ. Ovarium purpureo-punctatum. Sepalum posticum 5 lin. longum, basi subulato-lanceolatum, concavum, apice supra medium attenuatum, apice crasso-clavatum; sepala lateralia fere omnino connata, 5 lin. longa, 2½ lin. lata. Petala 4 lin. longa, angustissima, apice clavata. Labellum subpandurato-ligulatum, truncatum, læve v. obscure muriculatum, 2½ lin. longum, basi utrinque falcato-setacea. Columna clavata, 2 lin. longa, basi bituberculata.

A small, brightly-coloured Andine species, sent to Kew for determination, in March 1891, by Messrs. Charlesworth, Shuttleworth & Co., of Heaton, Bradford. It is allied to *R. xanthophthalma*, Rchb. f., but differs in shape of leaves, colour of flower, and other details. The lateral sepals are of the lightest yellow, with large crimson-purple blotches; the dorsal sepals and petals are also very light yellow, the former with a few purple spots near the base; and the lip densely covered with blackish-purple spots. The column is very pale green, with a pair of orange spots on

its swollen base. A plant from the same source flowered in the Kew collection in March of the present year.

14. **Dendrobium platycaulon**, *Rolfe*, *n. sp.* — Pseudobulbi valde compressi, ancipites, lanceolati, circa 3–5-foliati, 4–7 poll. longi, 1–1¼ poll. lati. Folia oblonga v. elliptico-oblonga, acuta, sessilia, 2½–3½ poll. longa, 1–1¼ poll. lata. Racemi breves, 3–6 flori. Bracteæ triangulari-ovatæ, acutæ, 1 lin. longæ. Flores straminei. Pedicelli 6–8 lin. longi. Sepalum posticum lineari-oblongum, obtusum, 7 lin. longum; sepala lateralia similia, leviter carinata, basi in mento 7 lin. longo producta. Petala sepalis paullo latiora. Labellum hastato-trilobum, late unguiculatum, lobo medio late oblongo emarginato, lobis lateralibus rotundatis, disco leviter tricarinato in medio. Columna brevissima.

A species closely resembling *D. lamellatum*, Lindl., but with the flowers twice as large, and the lip quite different in shape. The pseudobulbs are also considerably more elongated. The flowers, which measure over an inch in length, are straw-coloured. It was imported by Messrs. F. Sander & Co., of St. Albans, from the Philippine Islands, and flowered both in 1890 and during the following year. It has also been sent from the Glasnevin Botanic Garden, by Mr. F. W. Moore, having being acquired from the same source.

13. **Bulbophyllum densiflorum**, *Rolfe*, *n. sp.*—Rhizoma repens. Pseudobulbi ovoideo-oblongi, 1¼ poll. longi, diphylli. Folia oblongo-lanceolata, acuta, pallide viridia, circa 4 poll. longa, 10 lin. lata. Scapi suberecti, circa 5 poll. longi; racemi penduli, densiflori, 2 poll. longi. Flores parvi, lutei, fœtidi. Bracteæ elliptico-ovatæ, valde concavæ, breviter acuminatæ, glabræ, 2 lin. longæ. Sepalum posticum ovatum, obtusum, concavum, glabrum, 2 lin. longum. Sepala lateralia supra medium connata, 3 lin. longa, cæteris similia. Petala oblonga, apiculata, glabra, uninervia, 1½ lin. longa. Labellum ovato-oblongum, obtusum, carnosum, glabrum, 1½ lin. longum. Columna brevis, alis subfalcatis acutis.

A small species closely allied to *Bulbophyllum triste*, Rchb. f., but differing therefrom in its longer raceme of yellow, not deep purple, flowers, and in certain details of structure. It was sent to Kew by Mr. Nelson Campany, The Gardens, Thedden Grange, Alton, Hants, during September 1891. The sepals and petals are light greenish yellow and the lip deep yellow. The flowers have a rather fœtid smell. It is said to have been imported from the Eastern Himalayas.

16. **Eria cristata**, *Rolfe*, *n. sp.*—Pseudobulbi teretes, apice paullo incrassati, 3–5 poll. longi, 3–4-phylli. Folia oblongo-lanceolata, acuta, 2½–3½ poll. longa, 8–10 lin. lata. Flores gemini. Bracteæ ochraceæ, oblongo-ovatæ, obtusæ, parce pubescentes, 6 lin. longæ, 3½ lin. latæ. Pedicelli albido-pubescentes, 8 lin. longi. Sepala ovato-lanceolata, subacuta, 8–9 lin. longa; lateralia carinata. Petala lineari-lanceolata, subobtusa. Labellum 5 lin. longum, trilobum, recurvum, lobo medio obovato-rotundato tomentoso basi cristato, lobis lateralibus rotundato-oblongis obtusis, disco tomentoso obscure tricarinato, apice bicalloso, callis lævibus. Columna brevis.

A pretty little species, belonging to the section *Cylindrolobus*, which has been cultivated at Kew for several years. It was originally sent from Moulmein by Mr. C. Peché, in 1882. It is nearly allied to *E. marginata*, Rolfe, which, however, has the lip, and especially the side lobes, margined with red, and a quite different crest. *E. cristata*

has the sepals and petals pure white, and the lip yellow, somewhat darker on the disc and margins of the side lobes. The structure of the system of crests is rather complex. On the hairy disc between the side lobes are three obscure keels, which at the apex of the side lobes suddenly terminate in a pair of truncate very fleshy crests, at this point destitute of hairs; in front of these is a pair of deep cavities, one on either side, and between them an elevated plate covered with yellow hairs, thus forming a tuft or crest, in allusion to which the name is given. The column is white, with some yellow markings on the foot, and a yellow anther-case.

17. **Odontoglossum auriculatum**, *Rolfe*, *n. sp.*—Pseudobulbi ovoidei, compressi, 1–2 poll. longi. Folia linearia, subacuta, 6–8 poll. longa, 6–9 lin. lata. Scapi erecti, circa 8–12 poll. longi, laxiflori. Flores stellati. Sepala patentia, lanceolata, acuminata, 12–14 lin. longa, 3–4 lin. lata. Petala sepalis similia. Labellum longe unguiculatum, trilobo-hastatum, circa 15 lin. longum, lobo medio anguste triangulo acuminato, lobis lateralibus rotundatis, disco bicornuto. Columna elongata, 9 lin. longa, alis brevissimis crenulatis.

A pretty little species closely allied to *O. lindleyanum*, Rchb. f., but differing in having a hastately trilobed lip, the disc of which is light purple instead of brown. In other respects it is much like the species just named. The sepals and petals are light yellow with a large light brown blotch near the apex, and a few much smaller ones below. The long claw of the lip, the side lobes and crests are white, the disc light purple, passing into light brown towards the apex of the front lobe. It was imported by Messrs. F. Sander & Co., of St. Albans, with *O. nævium*, Rchb. f., and has been sent to Kew for determination on two or three occasions; a living plant has also been presented to the collection, and it has recently flowered. It seems quite constant in character, and different from anything which has before appeared, though at first I thought it must be an anomalous variety of *O. lindleyanum*. The name is given in allusion to the ear-like side lobes of the lip.

18. **Odontoglossum guttatum**, *Rolfe*, *n. sp.*—Pseudobulbi subcompressi, ovoideo-oblongi, ancipites, $1\frac{1}{4}$–$1\frac{1}{2}$ poll. longi, 1–$1\frac{1}{4}$ poll. lati. Folia lanceolato-linearia, acuta, 9–12 poll. longa, $1\frac{1}{4}$–$1\frac{1}{2}$ poll. lata. Scapus $\frac{3}{4}$ ped. altus; racemus multiflorus. Bracteæ ovato-oblongæ, acutæ, 4–5 lin. longæ. Pedicelli 9–10 longi. Sepala subpatentia, concava, lanceolata, acuminata, $1\frac{1}{3}$ poll. longa, 4 lin. lata. Petala paullo minora, subincurva. Labellum breviter unguiculatum, subhastatum, lobo medio acuminatissimo, lobis lateralibus rotundatis recurvis crenulatis, disco bicalloso, callis magnis erectis lamellatis, apice irregulariter dentatis v. truncatis. Columna clavata, alis amplis irregulariter fimbriatis.

This species was sent to Kew for determination by G. R. le Doux, Esq., of Langton House, East Molesey, in March of the present year, with the information that it is a native of Ocana, whence it was imported as *O. blandum*, Rchb. f., in 1886. It is allied to *O. odoratum*, Lindl., but differs in the shape of the column wings and crests, also in colour. In its fimbriate column wings it recalls somewhat *O. præstans*, Rchb. f. and Warscew., and *O. crocidipterum*, Rchb. f., which, however, differ greatly in other characters. The flowers are light yellow in colour, irregularly blotched with chocolate, the spots being almost suffused on the upper halves of the sepals, and elongated into three narrow lines at the base of the petals. The lip is bright yellow on the

reflexed side lobes, with a few small reddish-brown spots, the calli and disc nearly white, the front part of the lip chocolate and a few paler spots and lines on the erect sides of the unguis. The column is whitish yellow, with a few reddish-brown spots on the sides, face, and wings. The plant has since been presented to Kew.

19. **Vanilla ensifolia**, *Rolfe, n. sp.*—Scandens, caulibus elongatis sulcatis lævibus. Folia petiolata, elongato-linearia, subattenuata, acuta, 4–8 poll. longa, 6–10 lin. lata, petiolus 3–5 lin. longus. Racemi axillares, abbreviati, floribus subfasciculatis. Bracteæ lanceolato-ovatæ, acutæ, 2–3 lin. longæ. Pedicelli 1–1¼ poll. longi. Sepala lineari-lanceolata, acuta, 2 poll. longa, 3 lin. lata. Petala sepalis subsimilia, subfalcata, nervo medio paullo incrassata. Labellum elliptico-oblongum, crenulatum. Columna 1½ poll. longa. Fructus non visus.

New Granada; prov. Cauca, *Goudot*; Patia, *Herb. Pharmaceutical Society*, from Mr. T. Hanbury, 1884.

This is a very distinct species, readily distinguished from every other by its narrow, sword-like leaves. The lip of the only examinable flower is imperfect, so that it is impossible to add any details about the disc and crest. It is described from dried specimens.

20. **Spiranthes olivacea**, *Rolfe, n. sp.*—Planta circa pedem alta. Folia radicalia petiolata, lanceolato-oblonga, acuta, 1–1½ poll. longa, 5–6 lin. lata. Scapus 10–12 poll. longus, gracilis, pubescens, multiflorus. Bracteæ lanceolatæ, acutæ, 3 lin. longæ. Flores subsessiles, 3 lin. longi. Sepala lateralia linearia, subobtusa, sepalum posticum cum petalis in galeam connivens, lanceolato-lineare, obtusum. Petala spathulata, obtusa. Labellum lineari-oblongum, apice in limbum suborbicularem crenulatum expansum, basi subventricosum, medio bicallosum, callis parvis, pubescentibus. Columna lineari-clavata, 1½ lin. longa.

A small species, introduced from North Peru by Messrs. Charlesworth, Shuttleworth & Co., of Heaton, Bradford, and by them presented to Kew, where it flowered in March of the present year. It is allied to *S. Preslii*, Lindl. (*Cyclopogon ovalifolium*, Presl., *Rel. Hænk.*, i., p. 93, t. 13, fig. 1), also a Peruvian species. The leaves are of a dark glaucous- or olive-green shade, with a few very small white blotches. The sepals are light olive green below, tipped with very light pink above; the petals of a similar shade below, passing into pellucid white above, with a pink mid-nerve; and the lip also white, margined with green about the middle of the claw, which point is also a little broader and appressed to the sides of the column.

CCXLIX.—SISAL HEMP IN THE BAHAMAS.

The following interesting account of the fibre industry in the Bahamas has been recently communicated to Kew by his Excellency Sir Ambrose Shea, K.C.M.G., Governor of the Bahmas:—

Sir Ambrose Shea, K.C.M.G., to Royal Gardens, Kew.

Government House, Bahamas,
April 11, 1892.

Dear Sir,

I have asked the Crown Agents to order in the meantime six copies of the *Kew Bulletin* for this Government, and I have notified

parties wishing to become subscribers that I will have their orders forwarded.

I notice you give a good deal of attention to our fibre cultivation. It is really a most promising enterprise and I believe will financially realise all reasonable expectations.

It will not become what is called a boom, for the production is necessarily a gradual movement, but as far as the future of the industry can be inferred from experience and existing facts, the calculations of its progress and value may be made with an unusual degree of certainty, so stable are its general conditions.

The growth of the plant is unfailing, it being proof against drought and every known adverse influence. It matures fully in four years and then yields 10 or 12 annual crops without further cultivation. The fibre is of unsurpassed excellence, and a recent experiment shows that it takes a dye readily, and eminent fibre merchants in London have informed me that they only desire to be assured that they can depend on a supply.

Such a state of facts is full of promise for the future prosperity of the colony. The export is now beginning, and the whole for the year will be from 150 to 200 tons. This will be an increasing quantity in the succeeding years, and a careful estimate places the output at 14,000 tons in 1900. At the low price of 20*l.* a ton this would give an export of 280,000*l.*, which, added to the normal export of the colony (130,000*l.*), makes 410,000*l.* eight years hence (to which the intervening years will be a steady approach), and we thus have in view a production more than three times of any in the experience of the colony.

But there is no reason why it should rest here, and it can be predicted with as much safety as can belong to any forecasts into the future, that in ten years of the new century the industry will have reached a result of 50,000 tons, the value of which can be readily seen.

In these estimates I have taken due account of the competition which this colony has stimulated by its enterprise, and the price I have named will satisfy dealers in the article that I am under the influence of all necessary restraint in this respect. I do not think many of our imitators will be successful, for it requires special combined conditions of soil and climate to produce such a fibre as ours, and in a spirit of self defence, the legislature has extended for five years an Act now three years in existence, which prohibits the export of fibre plants from the colony. This must affect the competition which has been spoken of, for some of the places in question had been relying on supplies of plants from our growers when the first prohibitory law should have expired.

The cultivation in Florida has been proposed, but this is not seriously considered by us. The plant is inferior, wages much more than double what is paid here, and there is a well-known liability to frost, which is fatal to fibre growth. As far as the best informed judgment can at present be a guide, we have no grounds for apprehension that our position can be seriously disturbed, or that in any conceivable conditions in the future the fibre cultivation in this colony will be placed below the limits of profitable adventure. The Government have restricted for ten years the amount of Crown allotments to 100,000 acres, which embraces the maximum product of 50,000 tons I have referred to. These allotments have been widely distributed to secure for the largest possible number of the people the advantage of employment, and a disturbance of the labour market is also guarded against. One of the many attractions of this remarkable industry is in the fact that strikes are all but impossible, for they will have no plausible basis. The crop may remain

unharvested for months without injury, and the good sense of the people may be safely relied on to recognise this fact, and also to make them feel, as they now do, that men of means coming to the colony to engage in its fortunes are its best benefactors, and this is being brought home to them by the improvement in their condition arising from the operations in which capitalists have already engaged.

I am, &c.
(Signed) A. Shea.

CCL.—NONNEN PEST IN BAVARIA.

(*Liparis Monacha.*)

In the *Kew Bulletin*, 1890, p. 224, an account was given of a formidable forest plague which had made its appearance in Bavaria. The pest consisted of the caterpillars of a moth known as the "nonnen" that has been known to attack forest trees on the Continent more or less for the last 200 years. In 1890 the damage done was so great that the loss to the revenue from woods and forests was estimated to amount to about 40,000*l*. In a recent despatch received by the Foreign Office from Her Majesty's Minister Resident at Munich, and communicated to Kew, a further account of the Nonne pest is given with the details of the various steps taken to mitigate the attack. So far an expenditure of nearly 100,000*l*. has been incurred in the campaign against the nonne pest by the Bavarian Forest Department.

Foreign Office to Royal Gardens, Kew.

Sir, Foreign Office, 19th March 1892.

With reference to the letter from this office of July 7, 1891, I am directed by the Secretary of State for Foreign Affairs to transmit to you, to be laid before the Director of the Royal Gardens, copy of a despatch respecting steps taken to combat the "nonnen" in Bavaria.

I am, &c.
(Signed) James W. Lowther.

The Assistant Director,
Kew Gardens.

[Enclosure.]

Her Majesty's Minister Resident, Munich, to Foreign Office.

My Lord, Munich, 15th March 1892.

With reference to Mr. Helyar's despatch [No. 17 Commercial, of June 30th, 1891,] upon the terrible destruction of Bavarian forest trees by the "nonnen," I have the honour to inform your Lordship that in the debate on the estimates of the Bavarian Forest Department, Baron von Riedel, the Minister of Finance, made a very interesting statement in respect to the steps taken to combat the pest, and the result therefrom.

In a few words his Excellency stated as follows:—

"Previous to June 1889 the danger of so great a plague was not known. In 1888–9 several measures to destroy the 'nonnen' were taken, but none of a comprehensive character; from that time foresters had gradually learnt by experience.

"The false hope that the bare stripped fir trees would grow again did much harm, leading people to put their hands in their pockets, and sit still instead of taking active measures. Hundreds of marks, again, had been spent where thousands should have been laid out. No one had any idea of the real extent of the calamity. In 1890, 60,000 caterpillars were counted on one tree stem alone. The experience gained in the Dürrubucher Forest in Niederbayern had been of great service, and one could now combat the 'nonnen' with practical well-directed measures. With what energy they had been carried out was shown by the fact that since 1889, 79 kilometres, or 48¾ miles, of light railroad had been made in the injured forests. 1,700,000 cubic yards of wood had been cut in the Ebersberger Forest alone, and in general all the wood cut had been sold without material loss in price.

"Thousands of workmen had been employed and laborious steps taken to carry out a well conceived plan. It had been said that the lime rings were useless because the insects passed their lives in the upper parts of the trees. But it was proved that probably 70 per cent. of the caterpillars crept or fell to the ground particularly on warm days and returned in the evening. Thus by means of the lime rings, which stopped the returning insects in a mass, they were able to kill them by thousands, which proved the use of the rings. The diseases which attack the 'nonnen' were not yet sufficiently understood. The Government could not wait for an eventual deliverance from nature, but must bestir itself. In the Ebersberg Forest especially (23,000 morgen in size) [1 morgen = 1 acre] it was hoped to overcome the 'nonnen.' Communes and private persons had asked the aid of the State, but unfortunately money was wanting. Lime in abundance had been offered to the neighbours of the State forests; unfortunately some had refused, through want of belief or want of time. All ought to unite in combatting the evil. The campaign against the 'nonnen' cost 2,000,000 marks [100,000*l.*] as against 12,000,000 marks [600,000*l.*], the amount of the proceeds of the timber sales. By united exertions Bavaria might hope to drive away this great danger to her forests."

It will be observed that the Minister of Finance considers that there are hopes that the pest may at last be got rid of, but that this depends upon everyone interested carrying out the necessary remedies.

I have, &c.

(Signed) Victor Drummond.

The Marquis of Salisbury, K.G.,
&c. &c. &c.

CCLI.—PRICKLY PEAR IN MEXICO.

The spread of the Prickly Pear in South Africa has led to considerable interest being taken in the best means either to destroy the plants altogether, or to render them of some service in the rural economy of the country. In the *Kew Bulletin*, 1888, p. 165, and 1890, p. 186, there is given full information on these points. In a recent despatch received by the Foreign Office from Her Majesty's Minister in Mexico, and communicated to this establishment, there is an interesting account of the Prickly Pear in what may be regarded as its native country. Even there, however, the use to which the plant is put is not important,

and it is doubtful whether on this account alone it is worth while to stay the order for its destruction which has been issued by the Government of Cape Colony. As a picture of life in the arid parts of Mexico, where hardly anything else than Prickly Pear will grow, Mr. Fletcher's account is very interesting.

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, June 8, 1892.

I AM directed by the Marquis of Salisbury to transmit herewith a despatch from Her Majesty's Minister in Mexico, accompanied by a Report on the Prickly Pear in that country, which may have some interest for the authorities at Kew Gardens.

These papers being sent in original, I am to request that they may be returned to this Department when done with.

I am, &c.
(Signed) T. V. LISTER.

W. T. Thiselton-Dyer, Esq., C.M.G., F.R.S.,
Kew Gardens.

HER MAJESTY'S LEGATION, MEXICO, to FOREIGN OFFICE.

Her Majesty's Legation, Mexico,
MY LORD, May 19, 1892.

I HAVE the honour to acknowledge the receipt of your Lordship's despatch, No. 3 of February 17, 1892, enclosing copy of a letter from the Agent-General of the Cape of Good Hope, stating that he is anxious to obtain information respecting the Prickly Pear from Mexico, where in certain districts he hears that it is used as food for stock.

As my own experience is confined to the refreshing qualities of the fruit, I applied to Mr. Fletcher, manager of the Atlan Land Company, for a report, and he has sent me one which I think contains all the information required.

I also enclose an article on the subject, which originally appeared in *Longmans' Magazine*, and is copied into the *Popular Science Monthly* of New York.

I have, &c.
(Signed) SPENSER ST. JOHN.

The Marquis of Salisbury, K.G., &c., &c.,
Foreign Office.

Mr. FLETCHER to Her Majesty's LEGATION, MEXICO.

Tulancingo, State of Hidalgo, Mexico,
SIR, May 12, 1892.

IN accordance with your request I have the honour to forward to Your Excellency the following information about the Prickly Pear.

My experience is that the plant is almost invaluable in hot, dry, and specially sandy countries, where vast stretches have to be crossed by ox-teams and there is little or no water for man or beast. Some years ago I was well acquainted with that almost desert country lying

between San Antonio, Texas, and Chihuahua, Mexico; long before the advent of railroads in that part, and when nearly all the wool grown in the northern part of Mexico found its way to San Antonio, Texas, by means of large trains of ox-waggons, and I may safely say, that had it not been for that providence of nature, the prickly pear, the large traffic could not have been carried on, nor could the vast herds of sheep have been maintained in that dry arid region. It seldom rained there, and when it did the grass would spring up fresh and green, but, in a few days, the hot sun would parch it; then the winds would blow off the dried grass, leaving the ground bare again, excepting about the roots of the prickly pear where it was sheltered from the hot sun and winds and received some moisture from the roots of the plant. It appears to me that the cactus must derive its moisture and sustenance in a great measure from the air, as it thrives even on brick and stone walls in the driest climates; merely throwing out a few stray roots to prevent itself being detached by the winds or otherwise.

It is the custom when teams of ox-waggons (commonly called "prairie schooners") are travelling, to send men ahead in the afternoon to the place of camping for the night to prepare the supper for the oxen. Arriving at the destination these men set to work collecting piles of dry cactus leaves and roots with which fires are made—and here I may mention that in the absence of wood the dry plant makes excellent fuel—then the green leaves (or flattened branches to speak strictly) are chopped off the plant, stuck on forks and toasted in the flames until all the prickles are burnt off, when the leaves are cut into convenient "chunks" for the animals to masticate. This food should be allowed to cool well before it is eaten or it will sometimes produce indigestion and diarrhœa.

Cattle work and thrive on this food alone, and can go without water for several days without any apparent shrinkage in flesh or loss of muscular force. It is very curious to see the teams of oxen brace to their work and go ahead as soon as they see or smell the fire where their supper is being prepared, and when they have finished their cooked rations and are turned loose or herded, as the case may be, for the night, they will search for the ripe fruit of the plant, which is sweet, nutritive, and juicy, and abounds in great quantities nearly all the year round.

The fruit of this wild cactus is eaten by man, but is not considered wholesome, though very refreshing, yet the fruit of the cultivated varieties is quite so.

Sheep are exceedingly fond of the fruit, and when let out of the pen in the morning will race in search of the ripe fruit. Sheep will get fat in a country where there is little or nothing else but Prickly Pear; the plant needs no cooking for them, the narrowness of their mouths enabling them to gnaw at the leaves between the prickles; the leaf once opened in this manner it is an easy matter for the sheep to get at the remainder of the pulp. Sheep require little or no moisture in a Prickly Pear country.

The festive goat thrives even better than the sheep on the plant; being a climber he gets at the fruit on the upper leaves as well as the lower. There are in this country hundreds of thousands of goats maintained in the deserts on the Prickly Pear; they are killed for the sake of their skins and tallow. When the tallow is all extracted from the meat the residue is packed in bales, sent to the various markets, and sold to the poor for a cheap "meat food."

The young "leaf-shoots" or branches of the "nopal," as it is called in Mexico, are used here for various culinary purposes; they are gathered when quite young and tender, and the excrescences from which later on the prickles would develop are shaved off with a keen knife; they are then boiled in water with a certain proportion of salt until well cooked, like any other vegetable, and are then either cut into cubes to use in soup, having the flavour of the gombo of New Orleans, or sliced into narrow strips when cold, and made into a salad in the ordinary way with pepper, salt, vinegar, oil, &c., "al gusto," most refreshing and palatable, as I can assure you personally.

The sap of the leaves is used as a size to mix with lime for white-washing; the leaves are hacked with a knife, and then put into water for some time, this water being used for mixing with the lime; it is excellent for the purpose named, quite equal to the ordinary glue. I believe a vegetable glue of good colour could be made from the plant. Being a very fibrous, glutinous plant, I see no reason why it should not be a good paper-making material.

Of its medicinal qualities I know little; personally I have used it occasionally as a poultice for wounds, and to relieve rheumatism. To prepare the poultice the leaf is partially baked, or toasted in some way if an oven is not handy, then one of the outer side skins is taken off and the interior pulp minced with a knife and then applied. For a wound it can be used at an agreeable temperature, but for rheumatism it must be as hot as the patient can bear it.

All the above applies to the *wild* Prickly Pear; the cultivated species while retaining the same properties have additional merits, although cultivated in Mexico for the fruit alone.

The following are the principal varieties cultivated, viz.:—

The White Prickly Pear, the fruit of which has an agreeable acid flavour.

The yellow, rather sweeter than the former.

The crimson (Morada), large and small, quite sweet.

The "Tapona," called so by reason of its costive effect when eaten in large quantities.

The "Pelona" (naked—almost without prickles). There are two varieties of this species, producing yellow and crimson fruit respectively. Of all the Prickly Pears *this is the great forage plant*. It is almost without the objectionable prickles, and will grow in almost any climate if not very damp; the leaves are the largest and thickest, and while the average weight of the full-grown leaves of other varieties is 3 lbs., the leaves of this variety will average 8 lbs.

The Prickly Pear is generally reproduced by means of the leaves, and as it is necessary to dry them a little before planting, they will stand a long transportation.

In some parts of the country a wine is made from the fruit; here in Tulancingo a kind of sweet is made by squeezing the inside of the fruit through a cloth to extract the juice, which is then boiled in the same manner as the juice of the sugar cane.

One other species of the plant that I must mention before concluding is the "Xoconostle," the fruit of which makes a most delicious preserve. I feel sure it would "take" in England as it has that peculiar "foreign" flavour so much liked; it has a particular flavour of its own, as distinct from other jams as Indian Chutnee from the ordinary pickle of commerce.

The Prickly Pear can be easily eradicated at any time from the soil on which it grows, if it is thought better to change it for more profitable crops.

I trust that the information I have given Your Excellency may be of service.

I remain, &c.
(Signed) B. N. C. Fletcher.

Sir Spenser St. John, K.C.M.G.,
&c. &c. &c.

CCLII.—PALMYRA BASS FIBRE.

(*Borassus flabelliformis*, L.).

Owing to the scarcity of the Bass fibres hitherto obtained from two Brazilian palms, *Attalea funifera* (*Kew Bulletin*, 1889, p. 237) and *Leopoldinia Piassaba*, inquiry has been made in most tropical countries for palms likely to yield fibres of a similar character. A bass fibre has been obtained in Madagascar from a species of *Dypsis*; and more recently Lagos or West African bass has been obtained from *Raphia vinifera* (*Kew Bulletin*, 1891, p. 1). A fibre almost identical has still more recently been prepared in Ceylon from the Palmyra palm (*Borassus flabelliformis*). The following information has been obtained on this subject.

Director of Navy Contracts to Royal Gardens, Kew.

Admiralty, Whitehall, S.W.,
Sir, June 1, 1892.

I shall be much obliged if you will be good enough to inform the Department whether anything is known of a material called "Bassine" said to be grown in India and dressed for the English market at Colombo, as to its value as a substitute for Brazilian Bass, and whether it is likely to displace bass on account of its quality or price.

I am, &c.
The Director, (Signed) C. M. Heath,
Royal Gardens, Kew. For Director of Navy Contracts.

Royal Gardens, Kew, to Director of Navy Contracts.

Royal Gardens, Kew,
Sir, June 8, 1892.

I am desired by Mr. Thiselton-Dyer to acknowledge the receipt of your letter of the 1st instant on the subject of fibre prepared from the Palmyra palm as a substitute for Brazilian Bass.

As shown in the enclosed extract from the Report of the Director of the Botanical Gardens, Ceylon, the fibre from the Palmyra palm is being prepared in small quantities in the north of the island. The quantity available is evidently limited, and as the palm is an important

source of food supply to the people it would be impossible to develop the industry to any very large extent without affecting that supply.

As regards the value of the fibre in European markets it may be useful to communicate to you a copy of a letter received from Messrs. Ide and Christie, a firm of fibre brokers in the City, giving particulars of the prices recently obtained for the fibre. A small quantity of the fibre as received to-day is forwarded to your address in a separate parcel.

This fibre is apparently not so good as the West African Bass (*Kew Bulletin*, 1891, p. 1), and it is decidedly inferior in length and flexibility to the Bahia Piassava (*Kew Bulletin*, 1889, p. 237). Its chief use would probably be to adulterate these fibres and not to be used alone.

I am, &c.

The Director of Navy Contracts, Admiralty, Whitehall, S.W. (Signed) D. Morris.

Extract from the Report of the Director of the Royal Botanic Gardens, Ceylon, 1891, p. 15.

Palmyra Fibre.—The sheathing leaf-stalks of the palmyra, as of many other palms, contains a stiff thick fibre, and a new industry in the collection of this has sprung up, under the auspices of a Colombo firm, in the north of the island. These fibres or bristles are much like the "Piassaba" so largely exported from Brazil (the produce of the palms *Attalea funifera* and *Leopoldinia Piassaba*) for brush-making and are doubtless exported hence for the same purpose. Immense numbers of the palmyra exist in the Jaffna peninsula and the islands near, and it is in the latter especially that the business of collecting the leaf-stalks for sale has been carried on by the inhabitants. In Elavaitivu the value thus collected in six months was about Rs. 3,000, a great addition to the means of the people. Unfortunately, in their eagerness for this easy method of money-getting, they have treated the trees so badly that it is reported that in that island alone 1,000 young palmyras have been destroyed. As this palm is the principal permanent source of food in the country, and is besides of immense utility for timber, fences, &c., it became obviously necessary to put a stop to this reckless destruction, and I understand that steps have been taken to regulate the fibre industry, which, properly conducted, should become a valuable addition to the means of living for the inhabitants.

Messrs. Ide and Christie to Royal Gardens, Kew.

72, Mark Lane, London, E.C.,
June 7, 1892.

Sir,

We duly received your favour of the 2nd instant and have pleasure in sending you a sample of Palmyra fibre as offered on this market. This is of average quality and valued to-day at 28*l.* per ton in London.

The first arrivals of this fibre took place about a year ago, the scarcity and high values of Brazilian Piassava having induced the production and shipment of substitutes. The early imports realized from 36*l.* to 42*l.* per ton, against West Coast African Piassava 55*l.* to 65*l.*, but with

fuller supplies of these brush-making fibres (including split bamboo) market values have receded, and Palmyra ranges to day from 22*l.* to 33*l.*

The chief objection to Palmyra by manufacturers is that it lacks straightness, but experiments are being made in this country to overcome this defect, and should they prove successful it is claimed by importers and dressers that Palmyra should, for wear then, be found equal to the best Brazilian.

We are, &c.
(Signed) Ide and Christie.

D. Morris, Esq., M.A., F.L.S.,
Royal Gardens, Kew.

CCLIII.—MISCELLANEOUS NOTES.

Mr. Charles H. Curtis, a sub-foreman in the Royal Gardens, has been appointed Assistant-Superintendent of the Royal Horticultural Society's Garden at Chiswick.

The principal recent acquisitions for the Library are: De Tussac's "Flore des Antilles"; Ligou's "True and Exact History of the Island of Barbados"; Tchihatcheff's "Voyage Scientifique dans l'Altai Oriental"; and Gerarde's "Catalogus Arborum fruticum ac plantarum tam indigenarum quam exoticarum in Norts Gerardi nascentum, 1596."

Mr. A. Franchet, of the Paris Herbarium, has recently presented to Kew an almost complete set of his numerous papers on the Flora of China and Japan.

The trustees of the Bentham fund have presented a considerable number of expensive books, including the principal works on Fossil Botany by Heer, Schimper, Williamson, Saporta, Gardner, Binney, Lesqereux, and others.

We have also been able to complete, or nearly so, partly by purchase and partly by exchange, various Indian and Colonial periodical publications, such as the *Journal of the Asiatic Society of Bengal; Journal and Proceedings of the Royal Society of New South Wales; Proceedings of the Linnean Society of New South Wales* and the *Proceedings of the New Zealand Institute.* And through the kindness of Sir Ferdinand von Mueller we possess a set of the *Victorian Naturalist* from the commencement.

In his recent expedition round the north coast of Madagascar the Rev. R. Baron has discovered a Labiate with stinging hairs. This singular plant resembles our British *Urtica dioica* and *Lamium album* in leaves and general habit. It proves to be an undescribed species of the genus *Achyrospermum.*

A valuable addition to the HERBARIUM has recently been received from Professor E. Bureau, the Director of the Paris Herbarium, Jardin des Plantes. It includes 530 species of St. Hilaire's Brazilian collections, many of them types of species first described by St. Hilaire himself. Also a small set of Guillemin's plants from the same country; a further continuation of about 200 species of Delavay's interesting Yunnan plants, and some 450 of Faurie's Japanese plants, embracing the types of new species described by Mr. A. Franchet. Finally a set of Deflers's South Arabian plants. The last contains many species not previously collected since Forskael traversed the same country about the middle of the last century.

Last year Mr. J. J. Lister, M.A., presented to Kew a collection of dried plants made by himself in the TONGA ISLANDS, and chiefly in the island called Eua, where he spent several months in 1889 and 1890, studying the geology and natural history. The collection is not a very extensive one, but it is sufficient to show that the flora is a part of that common to the Fiji, Samoa, and other neighbouring groups of islands. All the genera and most of the species are the same, and although about a score of the species appear to be undescribed it does not follow that they are endemic, because the flora of the Fiji islands is still very imperfectly known.

ADEN SENNA.—Under this name a variety of Senna appeared recently at the London drug sales. It was made the subject of a note to the *Pharmaceutical Journal* by Mr. E. M. Holmes, F.L.S. From this it would appear that the leaflets, which are hairy, have occasionally appeared in European commerce and were detected by Balka in Mecca and Alexandrian Senna. It is stated from an experiment with an infusion of two leaves that it produced a full effect upon a strong man and caused no griping, in consequence of which it seems to deserve further investigation.

From the leaflets Mr. Holmes supposes the plant to be *Cassia holosericea*, Fres., a shrubby plant of Abyssinia and Nubia extending to Arabia and as far eastward as Scinde. The Kew Museum is indebted to the Pharmaceutical Society for a sample of this Senna.

At the request of the Colonial Office the services of Kew have been enlisted to obtain for the Administration of NEW GUINEA a supply of plants of the Jamaica banana (known in Trinidad as the *Gros Michel*), and also good seed of Liberian coffee and Arabian coffee, free from leaf disease. These plants and seeds were obtained through the good offices of the Botanical Department in Jamaica. They were examined and cared for on arrival at Kew and then forwarded to New Guinea through the courtesy of the Agent-General for Queensland. As nearly all coffee-growing countries in the Eastern tropics are more or less infected with coffee-leaf disease, this supply of sound seed from Jamaica will enable the new coffee industry in New Guinea to be started under favourable conditions. It is important however to keep the plantations as free as possible from contact with seeds and plants of coffee from any other locality in the East Indies.

BAMBOO GARDEN.—The collection of hardy Bamboos and allied plants having outgrown the space allotted them in the beds near the Temperate

House, a new garden has been made for them in the wood near the Rhododendron Dell. This garden is in the form of a shallow depression with sloping banks 12 feet wide and a central pear-shaped bed 125 feet by 75 feet. To make it, the surface soil had to be removed and the gravel taken out to a depth of about 3 feet. A large quantity of new soil and manure was added so that the bamboos have now a good depth of rich soil. Two new paths leading to the Bamboo Garden have been made, one from the Syon vista and the other from the Stafford walk. The bamboos planted in the garden are :—*Arundinaria Fortunei* (Bambusa Fortunei), *A. japonica* (Bambusa Metake), *Bambusa albo-striata*, *B. gracilis*, *B. nana* (Hort), *B. palmata*, *B. plicata*, *B. pumila*, *B. tessellata*, *B. Veitchii*, *Phyllostachys bambusoides*, *P. nigra*, *P. Quilloi* (Bambusa Quilloi), *P. violescens* (Bambusa violescens, *P. viridi-glaucescens* (Bambusa viridi-glaucescens), *Thamnocalamus Falconeri* (Bambusa Falconeri) and several others unnamed. Besides bamboos it contains such plants as *Arundo*, *Eulalia*, *Crinum*, *Funkia Yucca*, etc. It is also intended to bring together in this garden a number of the coarser growing monocotyledonous plants which can be grown in the open air at Kew.

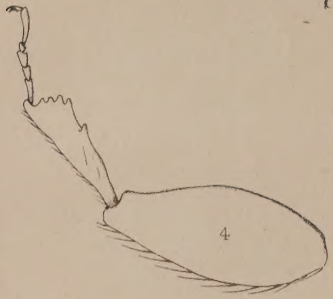
A.

Moth Borer. *(Chilo saccharalis.)*

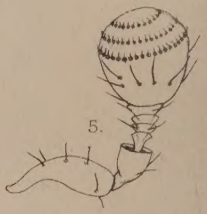
B.

Weevil Borer.

(Sphenophorus saccharı.)



C.



Shot Borer. *(Xyleborus perforans.)*

Sugar Cane Borers.